FIRST AERONAUTICAL WEEKLY IN THE WORLD FOUNDED 1909

FLIGHT
and
AIRCRAFT ENGINEER

No 2523 Vol 71 FRIDAY 31 MAY 1957

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Thomas Skinner of Canada, Ltd.
67 Yonge Street
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New York 6, N.Y.
Thomas Skinner and Co. (Publishers), Ltd.
111 Broadway
Telephone · Digby 9-1197

SUBSCRIPTION RATES
Home and Overseas · Twelve Months, £4 10s. U.S.A. and Canada $14.00

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Thoughts After Paris

LE BOURGET, with its seething Salon and wind-scoured aircraft park, are falling Viscount miles astern as we begin this column. The singing of Darts proves so tranquillizing that we can at least attempt a first appraisal of the great international exposition we are leaving behind, and which we already look forward to revisiting for the climactic week-end.

What comes to mind first? One thought above all: that this is, to a disquieting extent, an American show. Disquieting especially because Britain has been edged firmly—and without, apparently, caring over-much—into the shade. It is America's show not only because the great U.S. aircraft and engine builders have pulled out all the stops of their mighty publicity organs, but because the U.S.A.F. is at Le Bourget in massive strength (massive, at least, compared with the lone, lorn Hunter tucked away in a secluded corner). Could it be symbolic that the Globemaster looms over all?

We find ourselves devoutly hoping that next week-end this sad situation may be in some degree redressed: that "le Raf" may remind our good French (and American) friends that the lion still has wings and that, through having been clipped, these may prove all the stronger.

And what of France's own industry. Certainly it is going ahead—and in a more rational manner that at some earlier phases of its history. Several of its products, as will be gathered from this and our preceding issue, are not merely competitive: they are unrivalled. The French are putting up a good show; they are also putting on a good show. Whatever their domestic troubles, these are little in evidence at the 22nd Salon. We in Britain must see to it that Farnborough 1957 betrays no fear of the future, no suspicion of decay. And let it be seen that we have only regard for—not fear of—the big-thinking, big-doing, big-hearted Americans.

The Moment of Truth

THE fly on the wall of B.O.A.C.'s board-room, and the other one in the Minister's office, know much more than the official statements disclose about the reasoning which resulted in the Corporation's order (reported on pages 722 and 729) for 35 Vickers VC-10 jet airliners. The two insects must have had a puzzling time during the past few months: but whatever they may know that others do not, they cannot have been able to resist a buzz of applause when the final choice was made.

The decision is momentous, for it means that the British aircraft industry's strongest airliner building team, Vickers and Rolls-Royce, has entered a contestant for a place on the next plateau of air transport—the 600 m.p.h. plateau of high-subsonic, swept-wing, pure-jet travel.

The word "plateau" should not be pooh-poohed as the *cachet* of a transatlantic jet-promotion stunt. The Americans are not hoaxing the world's airlines and the public into accepting aeroplanes they would be better without. We have said before, and we say again, that the future of Britain's industry as a major exporter of first-line transport aeroplanes depends upon its grasp of the word "plateau's" full implication—which is that, for better economics or for worse (and probably there will not be a ha'p'orth of difference either way in the relative profitability of jets and turboprops) the airlines will be earning most of their money on the 600 m.p.h. plateau for perhaps 20 years after 1960. And, according to our own recent estimate, they will want about 1,100 jets of VC-10 calibre during that period.

Plateau or no plateau, the news that the VC-10 is to be privately financed—to an extent which we believe is unprecedented in Britain—merits particular applause. Private venturing tends to breed good products, much more so than do the commercially unhealthy requirements of prestige and flag-wagging: and though the technical task facing Vickers is immense, so is the potential reward of the market.

FROM ALL QUARTERS

JAVELINS—active in Exercise Vigilant, as related in this issue—are seen in production at the Gloster Aircraft works. Armstrong Whitworth are building aircraft of the same type. Javelin squadrons are now based at Odiham, Hants; Horsham St. Faith, Norfolk; and Leuchars, Fife.

The Vickers VC-10

IT was announced on May 22 by B.O.A.C. that, after a long study of several alternative types, the Corporation has decided to place an order for 35 Vickers VC-10 jet transports.

Few details of the VC-10 itself were disclosed in the brief B.O.A.C. and Vickers announcements. It is stated that the aircraft, which will be a 600 m.p.h. 120-passenger medium/long-range jet transport powered by four Rolls-Royce Conways, will carry "a very large payload" in B.O.A.C.'s Commonwealth routes. Emphasis is placed on the VC-10's "especially good airfield performance at high-level and high-temperature airfields," certain "unusual features" having been aimed at improving airfield performance.

The fuselage will be very similar in appearance (and, no doubt, in construction) to that of the Vanguard. It will provide high-density seating for up to 147 passengers, and as in the Vanguard, the freight holds will be very large. No illustration of the project has been released, at the time of writing, but it may be supposed that the engine layout will be of the tail-cluster type (see page 730), and that the wing will owe much to experience with the Vickers-Supermarine Scimitar.

Sir George Edwards, managing director of Vickers-Armstrongs (Aircraft), Ltd., commented as follows on the VC-10: "This aircraft has certain unusual features which are all aimed at improving airfield performance, particularly in conditions of high temperature and high aerodrome altitude such as are met on the B.O.A.C. Eastern and African routes. The world-wide advantages of a jet aircraft of this type with especially good take-off characteristics will, we believe, make the Vickers VC-10 a strong competitor with the U.S. jets in the same class." He continued: "The decision to go ahead with the VC-10 means that we will be offering a big propeller-turbine airliner, the Vanguard, from 1960 and the jet VC-10 from 1963. The Vanguard will, of course, have superior operating economy, especially over ranges up to 1,500 miles, and the VC-10 will offer a considerable increase in speed and good economy on the kind of routes we have indicated. It is our belief that there are large markets for both types of aircraft which are, in many ways, complementary to each other."

Sir George concluded: "We are pleased to have this opportunity to collaborate with B.O.A.C. to produce a flexible British pure-jet transport which we believe will keep the airline and the British aircraft industry well to the fore in the next decade. Like the Vanguard, the VC-10 is being financed privately by Vickers."

(*Implications for B.O.A.C., page 729; Editorial comment, page 721.*)

BLOODHOUND—Britain's new anti-aircraft missile by Bristol/Ferranti—is seen in this first-released picture (news item, col. 2). The makers state that this weapon will be the "mainstay of the United Kingdom defence system." The picture shows wrap-round boosts and twin ramjets.

Statement on the S.R.53

REPLYING to a House of Commons question on Monday, the Minister of Supply, Mr. Aubrey Jones, made official reference to the Saunders-Roe S.R.53 (subject of an extensive appraisal in our issue of May 24). This aircraft had not, he said, reached the stage of development at which a production order would be appropriate. The fact that the type was not required by the R.A.F. did not exclude supersonic fighters for the Royal Navy. This particular fighter "might well be the one determined on."

Gazelle-powered Bristol 192

NEW facts about the Bristol Type 192 helicopter for the R.A.F. can now be given. Powered with two Napier Gazelle Series 2 gas turbines, each of 1,300 s.h.p., it will weigh 18,000 lb all-up and have a cruising speed of 120 kt. Eighteen fully armed troops can be carried over a range of 250 n.m., or 25 troops over short distances. In the ambulance rôle the Type 192 will carry twelve stretcher cases.

Directorship for F. H. Pollicutt

CHIEF DESIGNER to Hunting Percival Aircraft, Ltd., Mr. F. H. Pollicutt, F.R.Ae.S., has been appointed technical director. After an apprenticeship at the R.A.E., he joined the Bristol Aeroplane Co., Ltd., in 1930, rising to be deputy chief designer. In 1951 he went to Folland Aircraft as chief designer, and in December 1953 joined Hunting Percival. He has recently been made a member of the S.B.A.C. Technical Committee, and is also an S.B.A.C. representative on the Joint Airworthiness Committee.

More About Bloodhound

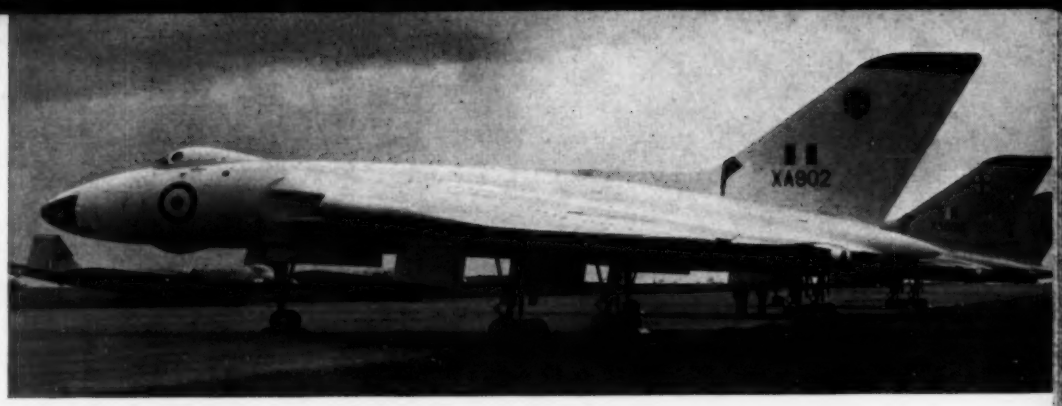
REPRODUCED on this page is the first security-released picture —deliberately indistinct—of Bristol/Ferranti's ramjet-driven Bloodhound surface-to-air weapon system. The following is part of an accompanying statement from Bristol:—

"Bloodhound is a semi-active homing missile which means that it is guided by a radar beam projected at the target, and reflected back to receiving equipment in the missile itself.

"As a hostile aircraft approaches, its position is plotted and followed by Radars. Co-ordinates of this position are fed automatically to a second Ground Radar Unit and the missile launchers move automatically to bear on the target. As soon as the echo from the target indicates, by its strength, that the target is within range, a green light flashes in front of the launch controller who has only to press the firing button to send Bloodhound roaring into the sky. From that moment the hostile aircraft has failed in its mission—no amount of evasive action by the target can shake Bloodhound off the scent."

The Long Way to Tokyo

ONLY one of the two records actually set by the R.A.F. Flying College's Canberra P.R.7 *Aries V* on its London-Tokyo-London flight last week is being submitted to the F.A.I. for confirmation. It is for the return trip which ended at West Malling shortly after 11 p.m. last Saturday, May 25. The 8,011 miles were covered in 17 hours 42 minutes 02.4 seconds. But the official speed had to be computed by the Royal Aero Club over the Great Circle route of 5,942.5 statute miles which leads over Scandinavia, Russia and Manchuria. Thus the aircraft flew more than 2,000 miles further than could be recognized, and the *official* speed was a mere 335.7 m.p.h. (540.29 km/hr) the slowest of any of the 18 point-to-point records now held by the Canberra. Its average



VULCANS — on parade at Waddington during the visit of the Duchess of Kent on May 21 (see page 727) — make another heartening picture.

"Flight" photograph

speed over the actual route from Tokyo to Fairbanks, Alaska, and then over the Arctic to Britain was 445 m.p.h.; and the average speed, excluding the halt at Fairbanks, a creditable 497 m.p.h.

On the outward flight the crew consisted of W/C. R. F. Hannan (captain), F/L. H. Hopkinson (second pilot) and S/L. B. Hamilton (navigator). The Canberra was brought home by W/C. W. Hoy, F/L. J. L. Denis and F/L. P. J. Lagensen. An additional seat for the co-pilot was installed beside the single navigator's seat. Refuelling stops were at Keflavik (Iceland) and Fairbanks, where the aircraft was serviced and refuelled by detached ground parties.

It was this route complication, allied to a delay of nearly 23 hours at Fairbanks with a faulty fuel pump, which reduced the average speed for the outward journey to approximately 150 m.p.h. *Aries V* left Runway 6 at London Airport at 10 minutes and 32 seconds past eight on Thursday morning. With three additional fuel tanks in the fuselage the aircraft was well loaded. The pilot found it hard work to hold *Aries V* against the brakes as he opened the two Avon engines to full power. Watching the departure were A.V-M. J. Cox, S.A.S.O. Flying Training Command, and A. Cdre. P. H. Dunn, Commandant of the R.A.F. Flying College, Manby.

Aries V gained time all the way to Fairbanks, where it arrived 58 minutes ahead of schedule. Then, 40 minutes after leaving for Tokyo, the fuel pump fault forced it to return—and brought, too, the virtual end of the record attempt.

At West Malling W/C. Hoy and his return-trip crew were met by A.V-M. H. H. Brookes, Acting C.-in-C. Flying Training Command, and A. Cdre. Dunn.

Bristol's New Wind Tunnel

SPEAKING at the formal opening of the new Bristol Aircraft low-speed wind tunnel at Filton last Friday, Mr. Aubrey Jones, Minister of Supply, said it was quite untrue to say, as some people alleged, that the Government "subsidized" the aircraft industry. "We invest in the industry," continued the Minister, "when we judge that there is a good chance of our getting a reasonable return on our investment. And of late our investments have turned out very well. We made quite a handsome profit on our investment in the Viscount and we hope to make quite a handsome profit on our investment in the Britannia. In recent years the trend has been towards increasing self-reliance in the industry. This wind tunnel is the latest example of the industry equipping itself with the facilities it needs."

A photograph of the exterior of the new tunnel appears on page 726, and we hope to publish a detailed description later.

Armstrong Siddeley and AiResearch

IT was announced last week-end that Armstrong Siddeley Motors, Ltd., and the Garrett Corporation, of Los Angeles, have concluded a licence agreement covering the manufacturing and selling rights in this country of the auxiliary gas turbines and air turbine starters developed by the AiResearch Manufacturing Divisions of the Garrett Corporation.

The Coventry company has exclusive rights in all British territories except Canada and will also be able to supply units and cater for overhaul and servicing to aircraft manufacturers and airline operators in the United Kingdom and other territories wishing to deal in sterling. This applies also to NATO air forces.

Prince Bernhard and the R.Ae.S.

AN Honorary Fellowship of the Royal Aeronautical Society has been offered to, and accepted by, Prince Bernhard of the Netherlands. Also announced is the award of the R.Ae.S. Gold Medal—the highest distinction which the Society can confer, "for work of an outstanding nature in aeronautics"—to Professor J. C. Hunsaker, "for his contributions to aeronautical research and education, including his inspired chairmanship of the National Advisory Committee for Aeronautics." Prof. Hunsaker—"whose work," says the Society, "has so greatly benefited aeronautical activities everywhere"—has been N.A.C.A. chairman since 1941.

An award of Honorary Companionship of the Society is to be made to Miss B. Voyce, an ex-member of the staff.

Other awards are announced as follows:—

The Society's Silver Medal (for work of an outstanding nature in Aeronautics).—Mr. M. B. Morgan, for his contributions in the execution and direction of aeronautical research and development. **The Society's Bronze Medal** (for work leading to an advance in aeronautics).—Mr. F. B. Greatrex, for his work on the reduction of noise from aero engines. **British Gold Medal for Aeronautics** (for outstanding practical achievement leading to aeronautical advancement.)—Mr. R. L. Lickley, for his outstanding practical contributions to aircraft design and development. **British Silver Medal for Aeronautics** (for practical achievement leading to advancement in aeronautics).—Mr. Charles Abell, for his engineering achievements contributing to efficiency in airline operations. **Wakefield Gold Medal** (for contributions towards safety in aviation).—Mr. Caradoc Williams, for his contributions to the development and use of radio aids. **R. P. Alston Memorial Medal** (formerly the R. P. Alston Memorial Prize; for practical achievement associated with the flight testing of aircraft).—Mr. Bernard Lynch, for his practical achievement in the flight testing of ejection seats.

GNATS—from the batch for the Ministry of Supply—are seen in company in the upper picture. On the right, other Gnats (for the M.o.S., India and Finland) are coming through Folland Aircraft's Gnat final-assembly shop at their Hamble, Hants, factory.

THUNDERCHIEF

Republic Aviation's Supersonic Fighter/Bomber

THIS journal last visited the Republic Aviation Corporation in the summer of 1955. At that time their main plant at Farmingdale, Long Island, N.Y., was churning out swept-wing F-84F Thunderstreaks and RF-84F Thunderflashes for the U.S.A.F. and NATO nations, as well as providing support for 4,457 straight-wing F-84 Thunderjets. In the works was the new YF-105, a completely new project.

Originally intended as a replacement for the F-84F, the F-105 was designed to have 50 per cent more speed, range and load-carrying ability. The project started as a level-sonic machine with two wing-root-mounted Allison J71s, but before metal was cut the powerplant was changed to a single Pratt and Whitney J57; and then came the Whitcomb area rule.

This rule was not incorporated in the YF-105A prototypes and Republic considered that the time taken in reshaping the body profiles to conform to it could profitably be utilized in effecting quite extensive redesign. As a result the YF-105A was turned into the much more capable F-105B (J75 engine); had this not been done, the type would probably not have merited production.

Like its predecessor, the F-105B has been planned as a weapon system, with a primary fighter/bomber mission supplemented by ability to operate as a fighter (and with a proportion of the output equipped as photographic vehicles). The Pratt and Whitney J75 gives some 16,500 lb dry thrust, and the F-105B was actually one of the first aircraft designed to use this engine. The company project engineer for the 105 was Mr. Sidney Huey; Air Force project officer was Lt-Col. Laverne Jochim.

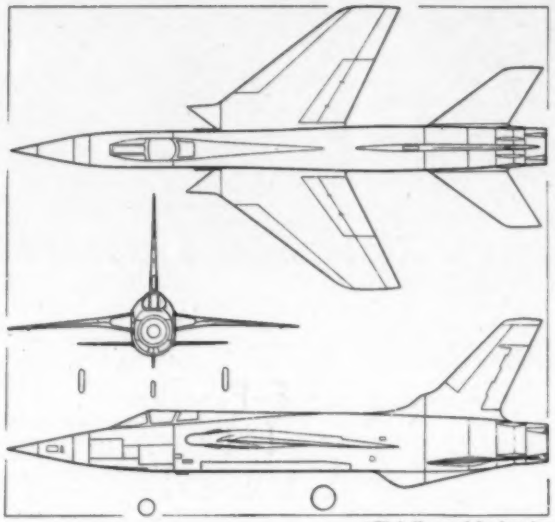
While the design of the 105B went ahead, the first of six YF-105As was flown—a month ahead of schedule—on October 22, 1955. The pilot was the company's chief experimental test pilot, Russell M. ("Rusty") Roth, who flew the new machine supersonically on its first mission and summed up the flight as "a very fine ride." Unfortunately the aircraft was substantially damaged early in 1956 when, during a Phase II stability evaluation, the up-lock for the starboard main leg failed in flight and the complete unit parted from the aircraft in a high-speed turn. Flying continued with the second machine, which had arrived at Edwards in December.

Several of the 105A prototypes are still engaged upon special tests. For some months they (and the later 105B) have been operating from the home field at Farmingdale as well as from military bases, and they have been flown by Maj-Gen. Albert Boyd, Air Research and Development Command deputy commander for weapon systems, and Maj. Stuard Childs.

Republic's fortunes have hinged heavily upon the F-105B. It was soon clear that here was the basis for a Mach 2 aircraft capable of filling most mission requirements of Tactical Air Command. About a year ago the company were awarded a contract for a test and evaluation batch.

Preliminary flight trials of the 105B were encouraging. The U.S.A.F. were never in doubt that they would need another supersonic fighter/bomber and, money being available, a choice had to be made between the F-105B and the somewhat similar F-107 by North American. Compared with the latter the 105B was rather slower but could carry a heavier weapon load. In the event the Republic aeroplane was chosen—partly, perhaps, because North American had more than enough to do in any case. Republic and the Air Force agreed to perpetuate the "Thunder" lineage by naming the F-105B the Thunderchief.

In its essentials it is a classically designed machine. The wing has a thickness/chord ratio of about 4 per cent over its outer regions, and carries unusual lateral controls. The vertical tail is of relatively high aspect-ratio, and accommodates several aerials. A single half-tailplane slab is pivoted on each side of the lower rear body, and separated from the latter by a foot or so of fixed surface. A ventral fin is fitted to increase lateral stability at very high Mach numbers.



"Flight" copyright drawing

Owing to the unusual intake system the inner wing panels behind the ducts have ample thickness, and Republic therefore arranged for the retracted main undercarriage units to lie wholly within the wing (most unusual in a 1,200 m.p.h. aeroplane). Thus released from the need to put the wheels in the fuselage Republic were able to give the Thunderchief much wider track than that of other American fighters. The nose unit retracts forwards.

Partly to provide the optimum intake-duct geometry and partly to leave room for a weapons bay, the wing is mounted in the mid position. Although the body is very capacious it is tapered off to a needle nose with a small included angle, conducive to minimum supersonic drag and obviating the possibility of a detached shock. Although a flat windscreen is provided the canopy is shallow.

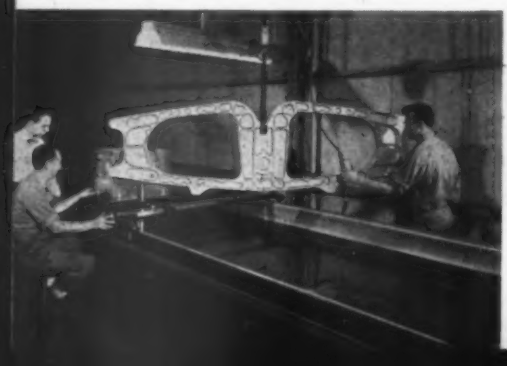
The big J75 has a large afterburner (Ceco AR-6 fuel control), and around the titanium after-body shroud can be seen fairings for the actuating rods of the two-position nozzle eyelids. Intake geometry is of absorbing interest. Starting with the letter-box-type leading-edge intakes of the RF-84F (a nose intake was ruled out by the radar requirements) Republic have arrived at a very sophisticated system. The sharp projections create inclined shocks right across the intakes. Splitter plates divide the flow and prevent breakaway, and the vertical wall shears off the boundary layer.

The photograph below shows the biggest structural "chunk," the wing bridge-piece which straddles the intakes and also carries most of the weapon load. The Wyman-Gordon company make this component with their 50,000-ton press.

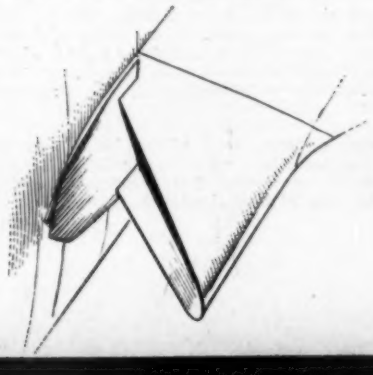
Gross weapons-load exceeds 8,000 lb, and the fuselage weapons bay can accommodate a free-falling nuclear (kiloton) device. The obvious nuclear-delivery system for such an aircraft is Labs (low-altitude bombing system), involving a supersonic run-in at minimum altitude and automatic tossing of the store during an Immelmann turn on to the reciprocal heading. This is demonstrated by models on the Republic stand at the Paris Salon.

General Electric supply the Thunderchief's automatic flight-control system and Bendix (Eclipse-Pioneer) make the air-data computer which serves as a centralized source of information on Mach number, angle of attack and other parameters which affect weapon behaviour. Also included in the F-105B weapon system (but not all used at once) are fixed guns, spin-stabilized rockets and such missiles as Falcon (GAR-1D) and Sidewinder (GAR-8). The basic F-105B is intended to double as a day fighter, and a production order has also been placed for the RF-105B photo-reconnaissance machine. There is also a very advanced F-105C.

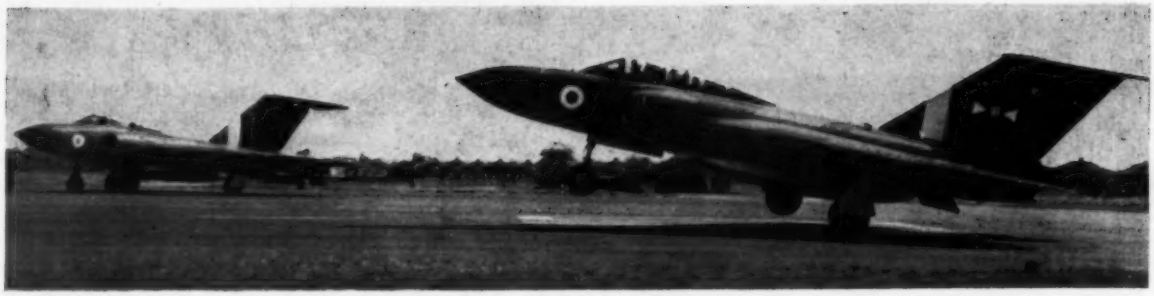
No doubt Sir Sydney Camm and his team at Hawker Aircraft are watching the F-105 with interest. Engaged in furthering the cause of their new strike aircraft, Sir Sydney probably sees in the American design its closest parallel.



The main bridge-piece straddling the intake ducts and joining the front wing spars is a single forging. It is here undergoing ultra-sonic insoection on a Curtiss-Wright Immerscope.



A provisional sketch of the Thunderchief port intake, showing the sharp-edged extension for making inclined shocks.



Exercise Vigilant

Fighter Command's Javelins and Hunters Meet a Threat

"FLIGHT" PHOTOGRAPHS

THE purpose of this year's annual air defence exercise, Exercise Vigilant, was simply—or perhaps not so simply—to ensure that in the event of an atomic attack against this country Fighter Command, in the words of the A.O.C-in-C., Air Marshal Sir Thomas Pike, would be "on the ball the very first day." And so, to give the Command practice in resisting the first atomic raid of any future war, Vigilant consisted of a simulation of that first raid and was repeated a further eight times during the three-day exercise (which started in the early hours of last Saturday, May 25). The weight of the offensive was the heaviest ever mounted in this annual exercise; the repetitive attacks were made at varying heights and from different directions; the height and speed of the bombers were simulated to be as near as possible to that expected from a potential enemy; and in situations where such factors were wholly unpredictable a "faster and higher" assumption was made and the bombers directed accordingly.

As well as being somewhat different from its predecessors in concept, Vigilant was also different in design. Instead of the defences spending long, often fruitless hours at stand-by, the raid effort was concentrated into three main periods (of two to three hours' duration) on each of the three days of the exercise. This in itself was a tribute to the efficiency of Fighter Command for, as one of the senior officers at the A.O.C-in-C.'s Press conference mentioned, the Command had never been caught napping at any of these annual defence exercises. It now being concluded that Fighter Command is *always* on the *qui vive*, the raid effort for the present exercise was planned to take place during three defined periods every 24 hours, two by day and one by night. When the raids were over the defences were instructed that no further major attacks could be expected for a specified number of hours. This, Sir Thomas Pike was at pains to point out, was not to make the exercise easier or more comfortable, but to get the most out of it by cutting out the time-wasting factors. During the breaks certain staffs were expected to carry out paper exercises—passive defence, redeployment of squadrons, effects of thermo-nuclear fall-out, etc.

Talking it over: (l. to r.) G/C. J. H. Iremonger, Horsham St. Faith Station Commander; Air Chief Marshal Sir Thomas Pike, A.O.C-in-C. Fighter Command; A.V-M. H. P. Fraser, A.O.C. 12 Group. In the heading picture one of Horsham's Javelins touches down, and below, a Javelin is seen being refuelled during a quick turn-round.

Taking first, as the occasion demands, our fighter defence component, there was the interesting development in that, for the first time, Hunters alone stood guard during the day effort; we had to admit, albeit a little sadly, that we had seen the last of the day-fighter Meteors. An interesting feature of the night activity was the presence of three squadrons of Javelins—No. 46 Squadron (Mk 1) from Odiham, and Coltishall squadrons Nos. 141 and 23, both recently re-equipped with the Mk 4 Javelins—operating from Horsham St. Faith. Ably supporting the powerful punch of the Javelin squadrons were Meteor 14s and Venoms.

Ranged against Fighter Command was a vast and heterogeneous array of "enemy" aircraft—Valiants and Canberras (from both Bomber Command and 2nd T.A.F.); Vampire trainers of Flying Training Command; Fleet Air Arm Sea Hawks, Gannets, Wyverns and Vampires (some of the Fleet Air Arm aircraft were also helping out in defence); U.S.A.F. B-45s, F-100 Super Sabres and B-57s (the American-built Canberra); Skyraiders of the U.S. 6th Fleet based on the carrier *Forrestal* in the Mediterranean; French Air Force Mystères; and sundry others, the whole combining to tax the defenders' recognition abilities.

Just over 3,000 raiding sorties were down to be flown and by Sunday night some 2,300 had been accomplished, with a further 24-hour effort in hand. Between 400 and 450 raiding aircraft were committed by day and somewhat fewer by night. As to the progress of the battle, the first of the projected nine "hammer blows" against the U.K. lost some of its weight through the

(*Concluded on page* 728)

WORLD'S LARGEST wind tunnel of wooden construction, Bristol Aircraft's new low-speed unit will be used, in conjunction with the supersonic tunnel completed in 1952, for development work on missile, helicopter and fixed-wing projects. The working section is 12ft wide × 10ft high × 25ft long, and will accommodate models of up to 9ft span. The building, seen here, also houses drawing offices, workshops and instrumentation laboratory. (Official opening: page 723.)

HERE AND THERE

Spirited Successor

IN its flight to commemorate the 30th anniversary of Col. Charles Lindbergh's solo Atlantic crossing, the Super Sabre F-100F *Spirit of St. Louis II* flew from McGuire A.F.B., New Jersey, to Le Bourget in 6 hr 40 min on May 21. Piloted by Maj. R. Risner of the U.S.A.F., it was refuelled twice *en route*. Lindbergh's crossing took 33 hr 27 min.

S.A.C. Command

SUCCEEDING General Curtis E. Lemay, new U.S.A.F. Vice-Chief of Staff, Lt-Gen. Thomas S. Power has been nominated Commander-in-Chief of Strategic Air Command.

Forty-nine to Go

SANDTOFT, a war-time bomber airfield near Doncaster, is being released by the Air Ministry and sold. It is one of the fifty Service aerodromes mentioned by the Air Minister in his recent Memorandum as surplus to R.A.F. requirements.

Highest Yet?

IN an attempt to exceed the world altitude record for balloons—set up in 1935 by Capts. Anderson and Stevens, who ascended to 72,375ft—Capt. J. W. Kittinger of the U.S.A.F. is preparing to make a flight during which he hopes to reach a height of over 95,000ft. The balloon, of two million cubic feet (helium) capacity, has a pressurized gondola and plastic envelope. (The 1935 record is also the F.A.I. official record for any type of aircraft.)

Lighter-than-air Race

STARTING from Hengelo, a balloon race will take place in Holland on June 16. Premier award will be the Coupe Jhr. I. L. van den Berch van Heemstede, replacing the Coupe Andries Blitz, won outright last year by Mrs. Boesman.

Lesser Lights

MR. E. T. JONES, Director-General of Technical Development (Air), M.o.S., was invited to Ottawa to lecture at last Monday's (May 27) annual general meeting of the Canadian Aeronautical Institute. The title of his address was *Some Lesser Lights of Aeronautical Glamour*.

R.A.F. at the Tournament

AT this year's Royal Tournament, being held at Earls Court, London, from June 5 to June 22, the major R.A.F. item will be the portrayal of a day in the siege of Malta during May 1942. In addition, 138 officers and men of the R.A.F. Regiment will give "a display of versatility," demonstrating work in the field when on operations and also arms drill, in varied time without command.

Pointing the Way

NOTICES with letters 15ft high, warning pilots to "keep off," are being painted on the disused runways at the Harwell atomic research establishment, which was formerly an R.A.F. station. Recently a U.S.A.F. T-33 which had landed there by mistake crashed during a JATO-assisted attempt to take off again. Arrows are being painted in the middle of the letters pointing to R.A.F. Benson, which is 10 miles away.

S.L.A.E. General Meeting

LORD BRABAZON is to be guest speaker at the a.g.m. of the Society of Licensed Aircraft Engineers tomorrow, June 1 (2 p.m., 26 Portland Place, London, W.1).

Overshooting—in Style

AN Egyptian pilot, Abdel Monel el Shennawy, landed at Schwechat airport near Vienna recently in a Mig-15 of the Czechoslovak Air Force. He told the Austrian authorities that he had taken off from Pardubice airfield (about 80 miles east of Prague) on a training flight in the direction of the Austrian frontier, which he had mistakenly overshot. He had been forced to land at Schwechat after running out of fuel.

E. J. Pope

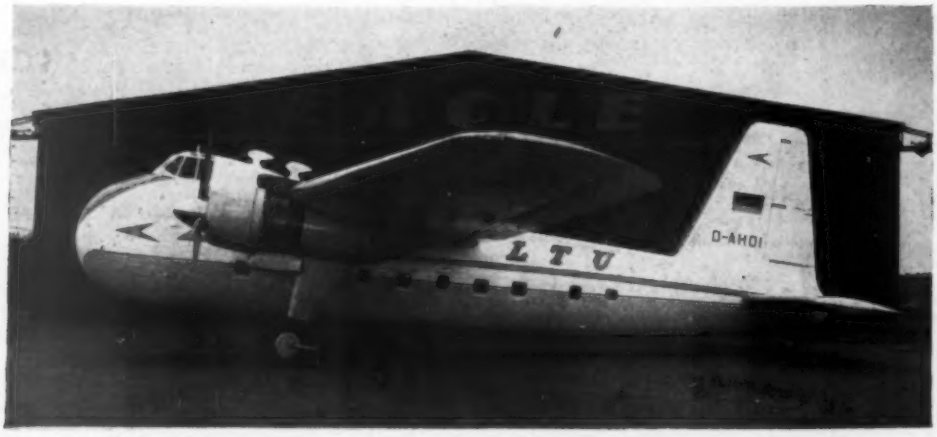
WE regret to learn of the death, on May 25, of Mr. Eric John Pope, flying instructor to Denham Flying Club. He was shortly to take up a post as C.F.I. at Cardiff. The funeral is at Golders Green Crematorium at 2.45 p.m. today, Friday, May 31.

Dr. Otto Böhm

WE also regret that Dr. Otto Böhm, who during the war devised a radar system which enabled low-flying German aircraft to be intercepted, died on May 17 at Beaconsfield. Dr. Böhm, who was 72, came to Britain from Berlin in 1936 and joined Marconi's Wireless Telegraph Co., Ltd. From 1941 to the end of the war he served with what is now the Admiralty Signal and Radar Establishment; also the radar aerial equipment which played an important part in the interception and sinking of *Scharnhorst* was largely his work.

"Dreidecker" Erratum

OWING to a transposition of caption numbers during printing, two of the World War I triplanes illustrated on page 666 of our May 17 issue were wrongly identified. The photograph numbered 5 actually showed the Brandenburg L.16 and picture No. 6 the Oesterreichische-Aviatik (Berg).



NATURALIZED: After seeing service in West Africa (as VR-NAZ) and as a War Office trooper (G-AIMA), this Bristol Mk 21 Freighter has received a German registration. It is seen here in its new point at Frankfurt-Main Airport after overhaul and conversion for Lufttransport Union by Eagle Aircraft Services of Blackbushe. It has been equipped as a combined passenger-freighter with provision for up to 52 seats and has been provided with a completely new radio installation.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

During her visit to Waddington on May 21 the Duchess of Kent, accompanied by the A.O.C.-in-C. Bomber Command, Air Chief Marshal Sir Harry Broadhurst, met aircrews undergoing training on Vulcans at No. 230 Operational Conversion Unit. She also watched flying by a Vulcan and by Canberras of No. 21 Sqn.

"Flight" photograph

Comet in Canada

FLYING last week from Winnipeg to Travis A.F.B., San Francisco, the R.A.F. Comet 2 which is carrying specialist navigation officers on a visit to Canada and the U.S.A. completed the journey in 3 hr 38 min at an average speed of 491 m.p.h.

McKee Trophy Award

FOR his contribution to helicopter operations during the construction of the Mid-Canada Early-Warning Line, S/L. Robert T. Heaslip, who commands No. 108 Communications Flight of the R.C.A.F., has been awarded the McKee Trans-Canada Trophy for 1956.

From February 1956 onwards six H-21s, six H-34s and up to ten H-19s were employed to airlift materials for building the Line, and during last year No. 108 Communications Flight flew approximately 9,000 helicopter hours, lifting over 10,000 tons of equipment and nearly 14,000 men.

The McKee Trophy was donated in 1927 by the late Mr. Dalzell McKee of Pittsburg, an aviation enthusiast who in 1926 made the first trans-Canada flight by seaplane, in recognition of the assistance given him by the R.C.A.F.

B.E.M. for R.A.A.F. Airman

FOR his part in trying to recover the body of the pilot of an R.A.F. Venom which had crashed into the sea about a mile off the Malayan coast, L. A/C. B. P. Hancock, an R.A.A.F. equipment clerk of No. 2 Airfield Construction Squadron at Butterworth, has been awarded the B.E.M.

On two successive days, L. A/C. Hancock was lowered from a helicopter into water teeming with jellyfish and stingrays. He continued his dives, locating the jagged wreckage on the second day in an underwater visibility of about 2ft, until trained divers arrived from Singapore. "Although unsuccessful in his attempts to recover the pilot's body," says the citation, "his untiring efforts were responsible for the recovery of much wreckage which proved valuable in determining the cause of the accident."

R.C.A.F. Trophy Winner

THIS year's winner of the Laurence A. Steinhardt Memorial Trophy, awarded annually to the most efficient all-weather intercepter squadron in the R.C.A.F., is No. 432 Sqn., based at Bagotville, Quebec. Known unofficially as the "Black Cougar" squadron, No. 432 is equipped with CF-100s and commanded by W/C. H. R. Norris. In 1956, the first year of competition, the trophy went to No. 419 Sqn. It was donated by Mrs. A. A. Sherlock, wife of an R.C.A.F. officer, in memory of her father; he was U.S. Ambassador to Canada and was killed in an aircraft accident in 1950.

R.A.A.F. Antarctic Operations

RECENTLY members of the R.A.A.F. Antarctic Flight returned to Australia after a winter in Antarctica, during which they assisted in survey work with the Australian National Antarctic Research Expedition and in the course of a flight along the Prince Charles Range discovered what is believed to be the largest glacier in the world—200 miles long and nearly 30 miles wide. On that occasion the pilot was P/O. J. Seaton, flying the Beaver. The other aircraft used by the Flight, which was commanded by S/L. D. Leckie, was an Auster. Replacement pilots have now gone out to the Antarctic for another season's work, led by F/L. P. Clemence.

Beverley Accident Court Martial

AT a court martial at R.A.F. Station Abingdon last Friday, Cpl. E. Sutton was found Not Guilty of negligence likely to cause damage to, or loss of, an aircraft. He was, however, found Guilty on a second charge of neglect prejudicial to good order and discipline, and was ordered to forfeit six months' seniority and to be severely reprimanded. Both findings and sentence are subject to confirmation. The court martial was the second arising from the Beverley accident on March 5, after which a fuel non-return valve was found to have been incorrectly replaced. At the first court martial C/Tech. W. H. N. Griffiss was found Not Guilty.

IN BRIEF

Of £2,758 received by the R.A.F. Benevolent Fund during March, £2,700 came from the R.A.F.A. branch in Hong Kong.

* * *

Funds of the two disbanded Nottingham squadrons of the Royal Auxiliary Air Force —Nos. 504 and 2504—have been used to buy a casualty operating table for Nottingham Children's Hospital.

* * *

A total of 70 R.C.A.F. aircrew and ground personnel will have attended instructional courses on the Comet at the de Havilland Aircraft Co., Ltd., Hatfield, by the time these are completed in mid-July this year. They will ferry Comets back to Canada.

This painting by Frank Wootton depicting the Royal Review of Bomber Command last July, when the Queen and the Duke of Edinburgh visited Marham, was presented to H.Q. No. 3 Group at Mildenhall on May 10 by Sir George Edwards, managing director of Vickers-Armstrongs (Aircraft), Ltd., makers of the Valiant bombers depicted.

(Above) Hunters scramble from Horsham St. Faith. (Left) At the same station, a night-shift of Javelin armourers.

Exercise Vigilant

(continued from page 725)

cancellation of the Valiant force owing to bad weather. Nonetheless, Fighter Command's all-weather force was fully committed in countering raids directed against the industrial Midlands and strategic bomber bases in Eastern and Southern England. Despite radio jamming the fighter defence claimed a good interception rate.

In the second phase some 400-500 raiders were mounted in an attack against British and American strategic bomber bases and most of the major cities. Some of the enemy coming in from the Atlantic were intercepted to the west of the Hebrides, and over the North Sea the defenders intercepted raiders flying from the direction of Jutland which were attacked up to 160 miles from the English coast. Continental-based aircraft of the 2nd and 4th Allied Tactical Air Forces from Germany, Holland, Belgium and France joined in some of the offensive activities.

The third maximum-intensity raid of the day included a raiding force, several hundred strong, launching simultaneous attacks from six different directions. Interesting "enemy" activity included Sky-raiders of the U.S. 6th Fleet making their long journey from *Forrestal* in the Mediterranean to strike at coastal targets from Aberdeen to the Isle of Wight. In the second night phase and for the first time in a major exercise, the Valiants tested the air defences, attacking in two powerful waves along a 300-mile front.

In the second daylight phase on Sunday the raiding effort reached its peak with Valiants in two strong forces, Canberra packs and swarms of fighters and fighter-bombers attempting to overwhelm the defences. All the day-fighter Hunters and some of the all-weather Javelins were scrambled to meet the attack.

At Horsham St. Faith, Norfolk, one of the U.K. fighter stations heavily engaged in the exercise, the first morning began dismally and unluckily with three early morning accidents. At about 7.15 a.m., and all within a space of 3½ minutes, a Hunter of No. 74 Sqn. suffered a manual reversion on take-off and ended in a ploughed field; a Javelin 4 of No. 23 Sqn. caught fire when taxying and became a total wreck, despite the valiant efforts of the station fire service and the quickly summoned Norwich City brigade; and simultaneously another Hunter, presumed to have had a flame-out, swept in across the airfield and broke up on landing. Fortunately there was no loss of life and the station commander, G/C. J. H. Iremonger, soon got things going again, cleared the runways and resumed operations. It was a good test of how, even on a day when the gremlins try to take over control, morale can remain high and a station carry on as if nothing untoward had happened.

There was only meagre hostile air activity in the Horsham St. Faith area. Nonetheless it was a warming sight to see these two all-weather Javelin squadrons—Nos. 23 (W/C. A. N. Davis) and 141 (W/C. P. L. Chilton)—in action. By day the Javelins reinforced the hard-pressed Hunter squadron (No. 74, S/L. K. N. Haselwood) in scrambles or at operational readiness and then carried on at dusk with a full-scale night fighter effort. The aircrews and the ground crews worked unceasingly in the chilling 30-knot north-east wind that swept the airfield. The little hostile air activity over the station consisted of two somewhat daring low-level attacks by a couple of French Air Force F-84Fs. The intrusion was dismissed as purely academic by No. 74, who claimed to have well and truly dealt with the offenders some miles out to sea. On this first day the Horsham squadrons flew nearly 30 missions and had a number of varied claims, including a double-figure toll of F-84Fs and a B-66 dealt with by No. 23 Sqn. at over 40,000ft. During the second night phase the A.O.C-in-C. Fighter Command visited the station.

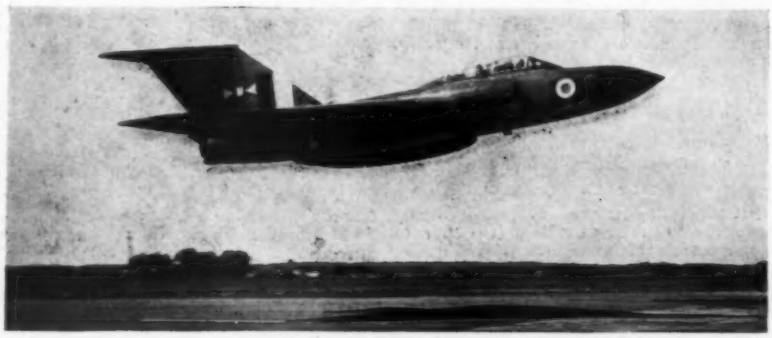
It was interesting to note that Fighter Command fought with what it had, no attempt being made to simulate air-to-air missiles. Indeed, it will be surprising if, despite the gradual introduction of guided missiles, this annual exercise does not retain its conventional character for some years to come. The eventual augmentation of the all-weather force with the P.1, with its service life of something like ten years, will insure a place for the conventional fighter, with the likely sequence of events being the gradual introduction of air-to-air guided weapons, a further phase with fighters supplemented by surface-to-air missiles and a final phase with the fighters supplementing the missiles.

The U.K. radar defence system as a whole is now undergoing a transformation, with automatic devices taking the place of the old manual plotting tables. In one of the sectors during Exercise Vigilant the finishing touches were put to an important experiment aimed at reducing long delays in the Control and Reporting System—and also aimed at saving a lot of time and a lot of money. Commenting at his Press conference on these new methods Sir Thomas Pike said, "In this country we are always rather accustomed to running down our own capabilities, but here is something we can be proud of." The new system, made possible by radar and ancillary equipment originally developed by the Royal Radar Establishment, is expected to be adopted throughout the Command.

During the exercise Nos. 2, 3 and 5 C.A.A.C.U.s (Civilian Anti-Aircraft Co-operation Units) flew subsidiary raids for the light A.A. guns and coastal R.O.C. posts. On the Saturday and Sunday the Home Office and the Royal Observer Corps held a thermo-nuclear fall-out exercise, "Treble Chance," covering the southern half of the country, and involving 10,000 members of the R.O.C., plus 300 members of the warning organization. For the purposes of the exercise megaton bombs were supposed to have fallen on the Ruhr, Amsterdam, the Thames approaches, Cardiff, Birmingham, Norwich and to the west of London. It is the task of the reporting organization to feed back to their sectors information relating to the position where the bombs have fallen, approximate size and the height of the burst. Fighter Command also contributed to this exercise.

Altogether, Exercise Vigilant (as its name implied) clearly indicated a high degree of awareness, together with top-line efficiency, within Fighter Command. G.R.G.

Stop Press: In the last phase of the exercise a Vulcan was intercepted at 50,000ft over the North Sea by one of the Javelins.



Javelin 4 ex-Horsham St. Faith.

Progress with Boeing 707 and Douglas DC-8 production: (left) joining of the wings of PanAm's first 707-120 at Seattle, and (right) Mr. Donald W. Douglas seen at the opening of his company's new DC-8 plant at Long Beach, one of the largest in the U.S.A.

CIVIL AVIATION

B.O.A.C. ORDERS VC-10s

THE B.O.A.C. order for 35 Vickers VC-10 medium jet transports will be the most expensive order—worth £68 million with spares—ever placed by the Corporation.

The total value of the orders on B.O.A.C.'s books, for Britannia 102s and 312s, Comet 4s, Viscounts (for associates), VC-10s and 707s now amounts to about £195m, of which more than £150m will go to British manufacturers. In *Flight's* estimate, this financial commitment to new turbine equipment exceeds that of any other world airline by a very wide margin. PanAm come closest with their £100m order for Boeing 707s and DC-8s, followed by American Airlines with an £85m order for 707s and Lockheed Electras.

The VC-10 will be B.O.A.C.'s staple transport aeroplane for the Commonwealth routes from 1963 until 1970—and perhaps, in developed form, beyond.

The Corporation will first employ Comet 4s for its Commonwealth jet services, and these aircraft should be able to hold their own against Boeing 707 and DC-8 competition between 1959 and 1962. The VC-10 may be regarded as a Comet 4 replacement, and particular emphasis has been placed on making its airfield performance at least as good as that of the Comet in the hot-and-high airport conditions of the Commonwealth network.

Vickers have not yet embarked on an export sales campaign for the VC-10 (final details of the project, and wind tunnel tests, have not yet been completed), but a number of airlines are already understood to be making a preliminary assessment of the aircraft. The export potential of this class of aeroplane, discussed in our May 3 issue, is very large.

Mr. Gerard d'Erlanger, the chairman of B.O.A.C., commented on the Corporation's decision as follows: "My Corporation has every faith in the ability of Vickers-Armstrongs (Aircraft), Ltd., to produce an airliner which, in partnership with our other new equipment, will help to keep B.O.A.C. pre-eminent on the air routes of the world in the mid-1960 period and beyond."

Leading article, p.721; VC-10, p.722.

B.O.A.C. have redecorated the interiors of their Monarch-service Stratocruiser fleet. Emphasis is on colour, and on luxury Slumberette seating for 40 passengers. There are also eight berths.

B.E.A.'s JET TRANSPORT

IT now remains to be seen in which direction B.O.A.C.'s sister corporation will turn for its own "new plateau" short-haul jet transport. It is no secret that the favourite in the running has so far been Bristol's Model 200 project; but delivery of a new short-haul design, by Bristol or by anyone else, could not be made much before 1963. It is likely that B.E.A. have been considering the need for a type with which to meet jet competition on their primary European routes in the meantime, and consideration has no doubt been given to the Comet 4B, announced last week and further discussed on page 749 of this issue.

It is reported that B.E.A., in addition to studying the Bristol 200, have been examining also an Avro short-haul jet project. Sir Roy Dobson (Avro managing director), speaking in New York, spoke of a three-engined, 70-seat airliner project which his company was studying.

VISCOUNT FLIGHT DEVELOPMENT

ADVANCED versions of the Vickers Viscount, incorporating new types of Dart turboprop, are to undergo an extensive flight-test programme. Three new versions of the Dart, all with three-stage turbines, are involved. They are the R.Da.7 Mark 520, the R.Da.7/1 Mark 525, and the R.Da.11 Mark 541 (ex Dart R.Da. 8).

The three Viscount variants in which these new engines will be progressively introduced are as follows:

V.806: Dart 520 engines, cruising speed 365 m.p.h. The airframe is as the V.800 (with a 9ft 3in longer cabin than V.700).

V.810: Dart 525 engines, cruising speed 365 m.p.h. Capacity as V.806, but structure specially strengthened for higher speeds and weights.

V.840: Airframe as V.810, but powered by Dart 541 engines giving cruising speed of 400 m.p.h. A change of powerplant converts the V.810 into the V.840.

The V.810-840 C. of A. trials programme will be carried out with a "test fleet" of four aircraft, as detailed below.

G-AMAV, The Viscount 700 prototype, is being fitted with one experimental Dart 520 engine driving the new "trapezoidal" Rotol propeller designed for the latest types of Dart. Tests with this aircraft will include engine and propeller development and de-icing of the V.810 type horn balanced rudder. In a preliminary test programme carried out last year G-AMAV achieved 400 m.p.h. in level flight.

G-AOYF, one of the fourteen V.806s ordered by B.E.A., will temporarily be fitted with experimental Dart 525 engines and modified to V.810 standards for full tropical trials in Africa in the autumn of this year.

G-AOYV, the Vickers-Armstrongs V.810 development aircraft, will temporarily be fitted with Dart 520 engines as specified for the V.806 series, but up-rated for test purposes to give Dart 525 powers. Work assigned to this aircraft includes a full range of handling trials.

N240V, the first of the 15 V.810-840 series Viscounts ordered by Continental Air Lines, will be powered by production Dart 525 engines. This aircraft (type number V.812) will be used for the final series of tests, extending from the autumn of this year

CIVIL AVIATION . . .

until the beginning of next year. Overlapping the tests on N240V will be a separate programme of tests devoted to the Viscount 806. As this type is in most respects similar to the Viscount 800, which is already in service, the trials will be less comprehensive than those for the V.810-840. They will be carried out in the autumn of 1957 with G-AOYG, one of B.E.A.'s V.806 aircraft. As mentioned above, another V.806 will be temporarily modified to V.810 standards for test purposes but on completion of the V.810-840 programme early in 1958 it will revert to production form for delivery to B.E.A.

WING PODS OR TAIL CLUSTERS?

THE favourite design controversy of a few years ago—buried turbojets *versus* wing pods—seems to have been settled in favour of pods. But a new controversy looks like being introduced by the European designers of jet transports: Where to put the pods? The French set the tail-cluster fashion with the Caravelle; and now Vickers and Bristol appear to have endorsed it with their VC-10 and Model 200 projects.

The Americans, aviation's fashion-leaders, have never wavered in their preference for wing pods. Is there any advantage to be gained by deviating from the trend of fashion? As in most matters of engineering, there is no question of someone being right and someone being wrong. Controversies arise when it is possible that, on balance, someone is more right than someone else.

Below is an attempt to set out the relative advantages of wing pods and tail-clusters. We started with no preset ideas; and although we finished with numerically more pros for tail clusters, we do not feel that equal weight can be given to each point on either side.

Wing Pods	Tail-Clusters
Much lighter wing and rear fuselage structure.	Better flaps, simpler wing structure.
	Quieter cabin.
Possibly superior turbine failure safety.	Superior crash-landing safety.
	Reduced debris-intake and ground collision hazards.
Lower polar moment of inertia in pitch and yaw.	Better assymetric case.
Possibly easier thrust reversal.	Less variation of intake angle of attack.

We are left with the thought that, for better or for worse, tail-clusters will at any rate be the jet airliner hallmark of a European industry with a mind of its own.

B.E.A.'s RECORD APRIL

THE month of April was a good one for B.E.A.; 200,000 passengers were carried, a number not before exceeded in the first month of the financial year. But Lord Douglas, chairman of B.E.A., sounded the following warning note: "B.E.A.'s financial position remains precarious and we have a long way to go yet before we can feel that there is a sufficient margin in our financial position to meet the inevitable ups and downs of a business as volatile as air transport."

Lord Douglas remarks in the current issue of the *B.E.A. Magazine* that although—as pointed out by the Air League—the British share of world traffic is declining, this is no reflection on B.E.A.'s achievements. Although (he writes) British air transport overall has grown only 75 per cent in the past five years (compared with the world figure of 93 per cent), B.E.A.'s traffic has increased 144 per cent—nearly two and a half times—in the same period. This is a rate of growth 51 per cent better than the world average.

THE CENTRAL AFRICAN AGREEMENT

ALTHOUGH the signing of the agreement between B.O.A.C. and Central African Airways ended the matter, the point of principle which was raised by Hunting-Clan will continue to be disputed. It is, therefore, necessary to put on record points which, raised since last week, seem relevant to this point of principle.

B.O.A.C., sensitive to criticisms that payment of £1,750,000 profit to C.A.A. over a period of ten years was "uncommercial," stated: "Although the figure . . . may sound large in itself, it has to be remembered that it is to be paid in respect of an agreement to operate scheduled services for ten years." It would, the Corporation stated, be equivalent to no more than a "reasonable percentage" of the "considerable" additional revenues earned.

B.O.A.C. went on to claim that the Hunting-Clan offer was "financially more attractive than ours." Mr. M. H. Curtis, managing director of Hunting-Clan, spoke of this B.O.A.C. claim as "extraordinary." "We are content to leave other people to judge whether it is commercial to enter into an agreement to guarantee someone else's profits if they buy your goods."

In Salisbury on May 23 Mr. Clive Hunting, a director of Hunting-Clan Air Holdings, said that it was his understanding that "B.O.A.C. had suffered a net loss of more than £1m over the past six years from its investment in associated and subsidiary companies."

B.O.A.C. perhaps got closest to the heart of the matter with this point: "We also relied on other [considerations], one of which was our long and world-wide airline operating experience, including 25 years of flying in Africa. Another was our desire to co-operate with C.A.A. in their development of a Commonwealth national airline."

K.L.M.'s Viscount 803 possesses a cabin which must be one of the most attractive Viscount interiors to date. Here is the 15-seat four-abreast first-class compartment, styled in soft greys, blues and reds. The 40-passenger compartment for tourists is similarly appointed, but has five abreast seats at a closer pitch. It is the first mixed-class Viscount to go into scheduled airline service.

AVRO's SUPERSONIC TRANSPORT

IN New York last week, Sir Roy Dobson, managing director of A. V. Roe, announced that his company was seriously considering an eight-engined supersonic jet airliner capable of carrying 100 passengers at 1,500 m.p.h. (Mach 2.3). He is reported to have said that "plans are already in the drawing-board stage"—from which it can be inferred that the project stage (largely covered by Avro's supersonic bomber work) has been passed. He stated also that, given an order now, it would take "seven to ten years to get such aircraft into operation." This is the earliest estimate yet made for the introduction of a supersonic transport.

The hard facts of the supersonic airliner are that lift/drag ratios, specific fuel consumptions and basic structure-weight ratios at present achievable fall far short of those required to obtain useful payload-range performance. A 100-passenger M=2.3 transport designed for the middle or late 1960s, even assuming radical aerodynamic, structural and engineering advances, is likely to be limited to medium-haul stage lengths. Even with this limitation, a staggering amount of development work will be required to bring a supersonic transport to fruition. Sir Roy Dobson said that £30m would be required just to get a prototype flying.

We have already endeavoured to show ("Supersonic Air Transport," February 8) that the operating cost of a supersonic airliner must reverse the downward trend shown by new equipment hitherto. But, looking ahead perhaps 20 years, by which time economical supersonics may be achievable, substantial markets await supersonic airliners, and these markets are likely to go to the pioneering firms.

"REQUEST DECCA DEPARTURE"

THE West German Civil Aviation Administration has just issued a *Notam* covering procedures at Frankfurt. It relates to Decca-equipped aircraft only, and the significance of the order—which follows precedents at home—speaks for itself.

"Special procedures for aircraft taking off from runway 25 will be implemented on an experimental basis, in order (a) to expedite traffic by making use of the potentialities of Decca to allow lower longitudinal and lateral separation minima than would apply between aircraft equipped with other navigational aids; and (b) to assist A.T.C. in outbound procedures of aircraft department Frankfurt.

"For the purpose of these procedures the operational accuracy is assumed to be plus or minus one nautical mile. However, the proposed separation minima are considerably in excess of this figure. This procedure will apply only to aircraft fitted with a serviceable Decca Flight Log. No reduced separation will be applied unless all aircraft concerned are so equipped. Pilots desiring to use Decca Flight Log for departure should advise Aerodrome Control on initial contact (normally when requesting 'taxi clearance') using the phraseology 'Request Decca Departure.'

"The word 'Decca' will be used in clearances which are based on the use of the Flight Log. For the lateral separation of aircraft departing Frankfurt special Decca tracks and Decca climbing areas have been established for the initial climb out. . . ."

At Schiphol, Amsterdam, has been built one of the largest hangars in Western Europe. Called the Albert Plesman, it is 660ft long by 70ft high, and it will be used by K.L.M. The cost was £660,000.

FIFTEEN VISCOUNTS OFF THE SHELF

THE opportunity for U.S. airlines to take the 15 Viscounts which Capital Airlines decided to defer is being brought home to them by the manufacturer. Vickers have flown one of the completed Capital aircraft (repainted as a demonstrator) to the U.S.A., with the company's chief test pilot, Mr. Jock Bryce, in command.

The *Wall Street Journal* has reported that Mr. Howard Hughes was "dickering" with Vickers for the possible acquisition of the 15 Viscounts by T.W.A. Officials of the airline declined to comment on the report but agreed, in answer to a reporter's question, that they "might not necessarily know about Mr. Hughes' activities."

SIR WILLIAM CRITICIZES THE MINISTER

AT the luncheon held in London to celebrate the first ten years of the I.A.T.A. Clearing House (*Flight*, April 19) we reported a "lighthearted" interchange between Sir William Hildred and Mr. Harold Watkinson, Minister of Transport and Civil Aviation, on the subject of landing charges.

Sir William has obviously not forgotten that interchange, nor does he seem to have regarded it as "lighthearted." At a luncheon in Washington earlier this month given by the Aero Club he said: "About three weeks ago there was sitting on my right at a luncheon the Minister of Transport and Civil Aviation in the United Kingdom. I mentioned, more in sorrow than in anger, what the British Government had just done with landing charges. They had shoved them up by a cruel percentage, and he hadn't the grace even to apologize. In fact, when I said he had put them up thirty per cent, he interjected, 'in some cases fifty,' and was absolutely shameless about this. That is another thing we have to deal with."

I.C.A.O.'s EUROPEAN CONFERENCE

THE new president of the I.C.A.O. Council, Mr. Walter Binaghi, was present during the second European Civil Aviation Conference which took place in Madrid earlier this month.

Fourteen recommendations were adopted dealing with the following problems: Abolition of visas; acceptance of identity cards or expired passports for visits of short duration; freedom for airport health control within Europe; airport facilities for handling transit cargo; provision of bonded stores facilities; exemption of children from governmental documentary requirements; clearance of outbound baggage; clearance of inbound baggage; handling of unaccompanied baggage; elimination of passenger manifests; traffic flow and/or installation arrangements at international airports; temporary importation of non-scheduled aircraft; use of clearance documents for statistical purposes; adequate facilities of hotels within Europe for the jet age.

There were eighteen European countries represented at Madrid, and observers attended from eight other countries, including the U.S.A.

On the wall behind Mr. Edwin Whitfield, traffic director of B.E.A., is the gold "winged wheel award" of the Airline Ground Transportation Association of North America. It was presented to him by the Association's president at London Airport on May 12 "in recognition of outstanding contribution to the aviation industry as a whole and . . . to the airline ground industry."

SKYWAYS' "LIVESTOCK" SPECIAL

SUBJECT to Government approval, a new service is to be pioneered by the British private airline Skyways. The company has applied to the Air Transport Advisory Council for permission to operate a scheduled freight service for livestock and "associated passengers" (i.e., grooms, trainers, etc.). The application requests rights of operation between Stansted and Beauvais, with an optional traffic stop at Blackbushe, near Ascot.

The service, if approved, will use York freighter aircraft (of which Skyways has a fleet of eighteen) specially fitted with adjustable horse boxes or other equipment suitable to the freight carried. If needed, six or seven horses, with fodder and their grooms, can be uplifted on each flight. The proposed service will leave Stansted at mid-day, with a flight time of one hour to Beauvais, the return service leaving France within two hours.

BREVITIES

THE possibility that B.O.A.C. services to Cairo may soon be resumed arises from the Egyptian Government's reported decision "to grant the request of British airline companies to resume their flights to Egyptian territory."

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It is reported from India that Air Ceylon will purchase Lockheed Electras for operation on international services in 1961.

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T.W.A. will start operations to London, Paris, Frankfurt and Rome with their Constellation L.1649A "Jetstream Starliner" fleet tomorrow, June 1. This is a month earlier than originally planned.

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Mr. Stanislav Krejcik, formerly head of I.A.T.A.'s European technical office in London, has been transferred to the head office in Montreal. His place has been taken by Mr. J. L. Gilmore.

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An extension to the terminal building at Turnhouse Airport, Edinburgh, was opened on May 16. A much larger extension is under consideration by the M.T.C.A.

* * *

Blackbushe Airport may be bought from the local authorities by the M.T.C.A. The present requisition order, under which it is held, expires in December 1959.

* * *

Qantas are to start a weekly mixed-class Super Constellation service from Sydney to Manila early in June. A thrice-weekly service between Sydney and Athens will begin on June 10.

* * *

Martin have developed a portable jet-noise suppressor for use on airports. It will cost between £180 and £3,500, depending upon the aircraft for which it is required.

* * *

Published by the Leicester University Press, the *Journal of Transport History* for May 1957 contains a history of London's airports by Mr. Peter W. Brooks of B.E.A.

* * *

Career Opportunities with the Airlines, an illustrated booklet, has been published by the Air Transport Association of America, 1107 16th Street, N.W., Washington 6, D.C.

* * *

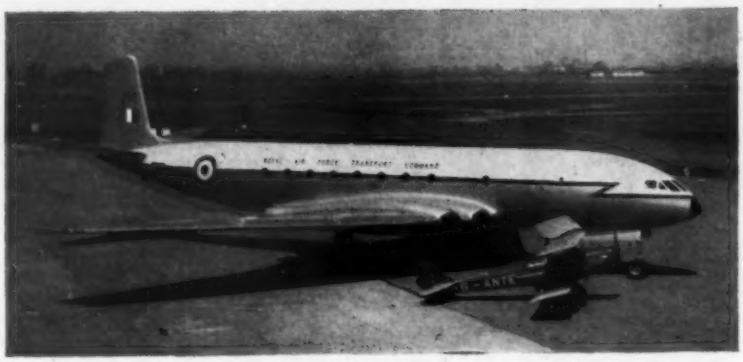
A DC-7C of K.L.M. made a special flight from San Diego to Paris on May 23 to commemorate Col. Lindbergh's flight from New York to Paris. The airliner took 21 hr 52 min and followed Lindbergh's route from New York.

* * *

Yeadon Airport has now been derequisitioned. Protracted purchase negotiations between the Air Ministry and Leeds and Bradford councils preceded a request for derequisitioning last November. Plans are in hand for re-surfacing the runways.

* * *

An informative and attractive booklet on London Airport, and the aircraft which are to be seen there, has been added to the ABC series, price 2s 6d. The publishers are Ian Allan, Ltd., of Hampton Court, Surrey. Another booklet, published at 5s by Travellers Guides, of 111 Baker Street, London, W.1, provides a complete guide to travel from all London's airports.



Unusual visitor to "Flight's" club page is XK716, the first Comet 2 constructed at de Havilland's Broughton plant, Chester. The big machine happened to be in the picture when this photograph of Tiger Moth G-ANTE, of the works flying club, was taken.

CLUB AND GLIDING NEWS

A STRONG gusty wind at Elstree last Saturday made certain items in the Flying Club's At Home—such as formation take-offs by Tiger Moths—particularly interesting for both spectators and pilots. Essentially a light-aircraft affair, the pleasant and varied programme included individual demonstrations, formation items and a number of races. Naturally enough, the club's instructional fleet of Chipmunk, Austers and Hawks were well represented—and, indeed, a formation trio of these types began the flying display. Among the interesting "extras" were the Automobile Association's Auster Alpine flown by D. Whitehead, Comper Swift G-ABUS in the hands of David Ogilvy, an Edgar Percival EP.9 flown by Harold Best-Devereux, and a Cessna 170 (converted to tricycle 172 standard) of the South Ruislip Aero Club handled by the club's president, Master Sgt. B. L. Cook.

An elegant demonstration that engines are not really necessary was given by Arthur Doughty of the London Gliding Club in a Slingsby Kite II; a well-positioned and graceful display in spite of the strong wind. At one point in the programme a bearded, aged aviator took over the Elstree Chipmunk with incredible results, this gentleman's resemblance to Bill Bailey of the club's instructional staff being far from coincidental. The solo items, which included Tiger aerobatics by C. A. Nepean Bishop, were interspersed with races by members of the Tiger Club, Elstree instructors on Hawks, and a mixed Tiger/Hawk quartet; and formation flying of a high standard by the Tiger Club and Elstree Flying Club.

THERE is a certain timeless quality about a flying club's At Home. Last Sunday's occasion at Luton—the marquees, the "tea patrol," the de Havilland Moths—were all reminiscent of similar occasions ten or even twenty years ago. Only at the end of the show was the illusion shattered. Barry Radley, chief test pilot of Napier, gave a polished aerobatic performance in a Jet Provost 1; happily—for warlike intrusion would have jarred—in Hunting Percival's own white and silver civil-registered aircraft.

If attendance is any measure of a party's success, Luton Flying Club had an outstanding day; taking advantage of the sunny but blustery weather, an enormous crowd engulfed the available standing space, queued endlessly for joy-rides in a Rapide flown by Mike Randrup, and made vast inroads into the refreshments. Officials had to be diverted to guard the visiting aircraft—among them four Hawk Trainers and a Chipmunk which arrived from Elstree in formation—and the programme became rather protracted. But Barry Radley showed his versatility with some delightful aerobatic and crazy flying in a Tiger Moth, an elderly and slogan-bedecked Austin (complete with stove-pipe) was bombed with flour and a row of tethered balloons were destroyed with some fancy shooting from the air. (Or so we were asked to believe; later the Hidden Assistant was revealed.) In spite of the strong wind the complete programme, and some additional items, was attempted. A demonstration of a Saab Safir was a joy to watch, but some difficulty was experienced in launching an Olympia sailplane in the conditions. A good day, and when it was over the departing visitors—Percival Q.6, Whitney Straight, Fairchild Argus, Hornet Moth, and many others—formed a nostalgic little pageant of their own.

THE Government's policy in connection with gliding was the subject of an adjournment question by Sir Roger Conant in the House of Commons on Tuesday, May 21. Sites for new clubs and greater security of tenure for several existing clubs were urgently needed, he said. The possibility of establishing a national or Empire gliding centre in this country depended upon having a suitable site available with adequate security of tenure. Sir Roger hoped that the airway problem in the neighbourhood of Camphill would not put an end to soaring at the Derbyshire and Lancashire Club's site. Surplus R.A.F. equipment, he suggested, should be made available to the gliding clubs.

Mr. Frank Beswick said he knew of no sport in any country in which the keenness, self-discipline, self-help and general sense of responsibility in administration which was encountered in gliding was excelled. Because of the benefits the sport brought to the individual and to the nation at large, he hoped that some more official encouragement could be mustered. "I was grateful for the way in which I was received recently at the Air Ministry," he continued, "when I took a deputation there on the subject of Lasham, and assistance was given very readily in removing one or two petty restrictions. But there remains this problem of some security of tenure there. . ."

Replying, the Joint Parliamentary Secretary to the Ministry of Transport and Civil Aviation, Mr. Airey Neave, began, "The sport of gliding is growing in popularity and is full of fascination for people of all ages. . . There is a vigorous spirit in the gliding movement and a sense of pride and independence which we all greatly admire." Mr. Neave went on to refer to "two major problems." Firstly, he was well aware of the problem of sites, but "This is not a very easy matter to solve." Concerning Lasham, "the position at the moment is that the Surrey Gliding Club has been offered a lease by the Air Ministry for quite a substantial period. Negotiations are now proceeding. . ." The second problem was that of airways, which concerned the Camphill site; on this subject, Mr. Neave said "we are now discussing a scheme whereby, although the base of the airway would still be 3,000ft, it should be moved slightly westward. Glider pilots should be able to soar safely and without restriction to the east of Camphill. It is also proposed that, in order to give greater freedom in the westerly direction when necessary, the controllers of the Manchester Control Zone should be informed, and traffic along the airway would then not be cleared to fly below 5,000ft. . . nothing is yet final. . ." Concerning equipment, the Parliamentary Secretary disclosed that there was some surplus equipment in the form of wire cable available; samples were being offered to the B.G.A. and "this is an example of the help and encouragement which we will continue to give to the gliding movement."

The gliding movement clearly has little reason to celebrate this statement of the Government's lack of policy. Questions in *Flight* as well as in Parliament have for years been answered with the same laboured statements of the obvious, the same attempts to present evasions of issues as firm support, and the same lack of any sign of real "help and encouragement." Not until Lasham Gliding Centre is securely established, on reasonable terms, will there be much cause for celebration.

TOMORROW afternoon, June 1, an air display and club rally is to take place at Fairwood Airport, Swansea, following the airport's official opening by G/C. Douglas Bader in the morning. Organizers of the display, and of an Air Ball this evening at 8 p.m., are the Swansea and District Flying School and Club.

THE third International Air Rally of the Swiss Watch will take place at Bienne on July 5-8. Points will be awarded for accuracy in time of arrival, and for a spot-landing competition, and there will also be a *Concours d'Elegance*, but (to quote Rule 4 of the contest) the object of the rally is "chiefly touristic and gastronomic." Details and entry forms (which should be returned by June 10) are obtainable from the president of the Aviation Club of Bienne, Dr. Dominique Weibel, Chemin de la Thielle, Nidau/Bienne, Switzerland.

TAKING advantage of exceptional weather conditions, ten sailplanes of the Warsaw Aero Club carried out a massed cross-country flight on May 5. Comprising four Jaskolkas, four Muchas, one Russian-built A-9 and one ex-German Kranich two-seater, the aircraft covered distances between 290 and 420 miles.

PROVISIONAL seeding of the British team for the 1958 World Gliding Championships, announced recently by the British Gliding Association, is as follows: 1, A. J. Deane-Drummond; 2, H. C. N. Goodhart; 3, P. A. Wills; 4, G. H. Stephenson; 5, D. G. Ince; 6, G. A. J. Goodhart. The final selection will take place after the National Championships at Lasham.

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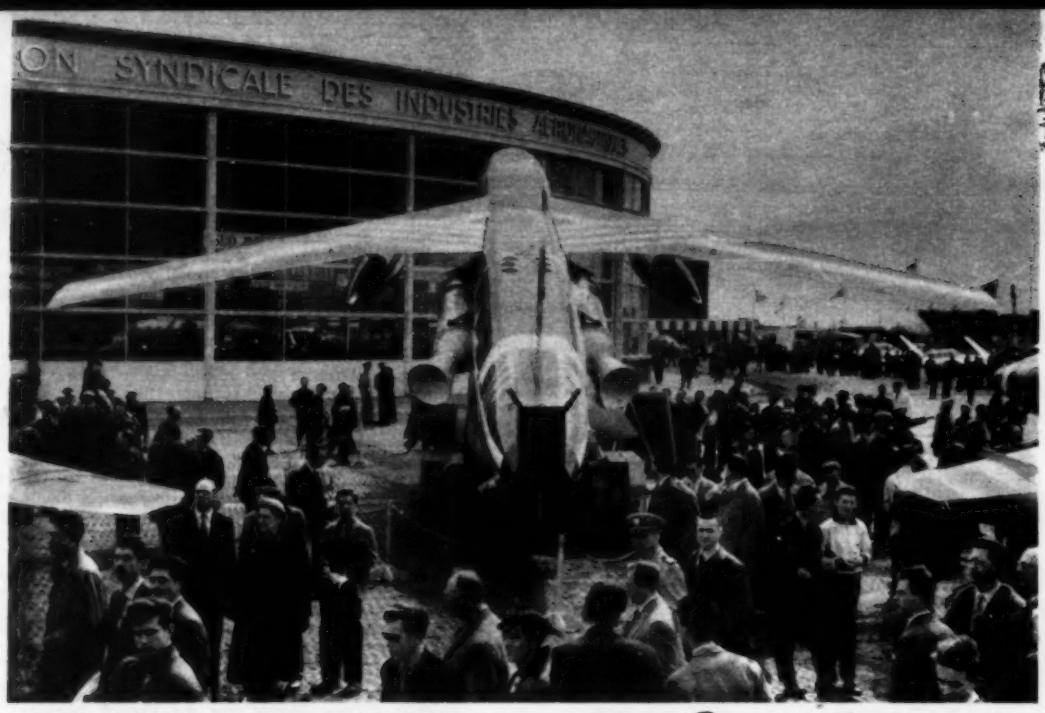
31 May
1957



The fearsome Northrop Snark strategic missile heads the American parade "FLIGHT" PHOTOGRAPHS

THE PARIS SHOW

A FIRST APPRAISAL OF THE 22nd SALON

EXCEPT for last-minute scene-shifting, which seems endemic in all shows of the kind, the 22nd International Aeronautical Salon was ready to be formally opened on the chilly grey afternoon of Friday, May 24. France's disturbed political situation made Presidential officiation at this traditional Parisian event inadvisable; but M. Bourgès Maunoury, the Minister for National Defence, was a fitting deputy.

The kindlier weather of Saturday was a little spoiled by the horseplay of the wind; but when the *Flight* contingent retired from the field at mid-afternoon to compare and consolidate notes the entrance turnstiles were still ticking lucratively round. A few fortunates had been whisked in from Paris at 3,000 francs a head in the Twin Pioneer.

On Sunday—sunny, but again with a pummelling, snatching wind—we took a census of the aircraft park and made the list as follows: *France:* C.M. 170, C.M. 175, Mystère IV A, Super Mystère (No. 2), Bréguet 763, Potez 75, Noratlas (civil, with Palas boosters), Caravelle (mock-up), assorted Alouettes, two Djinns, H.D.34, Durandal, two Vautours, Broussard and an RF-84F of the French Air Force. *U.S.A.:* TF-100F (the transatlantic *Spirit of St. Louis*, with tricolor painted nose), F-100D, B-57, C-123, C-124, C-130, B-66, B-47 and H-21. *Great Britain:* Sycamore, Whirlwind, Widgeon, Hunter, Skeeter, Twin Pioneer, H.D.M. 105 and Herald. *Poland:* Biês and SM-1. *Czechoslovakia:* Avia 14 (Il-14 licence), Super-Aero, Trener 6, Metasokol, Agricolta. *Spain:* Saeta. *Italy:* Falco, Sagittario II, F.N. 333, two Agusta-Bell 47s. *Holland:* Friendship. *Germany:* Do 27, R.W.3.

It will be judged that American representation—proclaimed as marking the U.S.A.F.'s golden jubilee—is dominant; as, indeed, it is indoors, with a massive continent of U.S. stands girt about by the lesser tracts of European exhibitors.

In the star-spangled manner America thus makes her first heavy bid for prestige and business in the Old World. Certainly this is not Great Britain's year; but whether, as a reader has suggested, visitors are imagining that our aircraft industry has begun to decay as a result of the new Defence policy we may only conjecture. *Flight's* immediate concern is a factual record of the aircraft, engine and missile exhibits; and before essaying the task it remains to record that as the present writer returned on the Sunday afternoon the light-aircraft display was well under way. One glimpsed from the passenger-departure building and from a waiting Viscount the H.D.M.105, Do 27, Sycamore, R.W.3, Super Aero, Metasokol and Trener being put through their paces. The H.D.M.105's performance seemed quite uninhibited, despite the newness of this Anglo-French prototype; and the Do 27 was nothing short of astounding, as it sat almost motionless in the driving wind. A trick of the Metasokol was extension and retraction of the wheels in an elapsed time of a second.

CIVIL TRANSPORTS

Armstrong Whitworth A.W.650 series. A number of fine models on the company's stand show the various configurations which have been proposed for these machines. Wing structure is

One of the two Vautours, with attendant weapons and attentive visitors.

A reversed tricycle undercarriage distinguishes the Metasokol from otherwise similar contemporaries.

THE PARIS SHOW...

based on that of the Shackleton, so that the same spar-boom milling machines are available, and the company already has an exact estimate of such factors as performance and fatigue life. The Dart powerplants are virtually identical with those of the Viscount, though, as far as possible, the mountings are arranged to be interchangeable with those for the Tyne. The outer Darts can be very easily removed.

Most interesting of all is the variety of fuselages to be made available. In addition to military variants, there are the freighter/coach pressurized fuselages for the A.W.650 (four Dart RDa. 7/2) and the A.W.651 (two Tyne RTy.1); the very large two-deck unpressurized unit for the A.D.670 car ferry, to take six cars and 30 passengers; and the similar unpressurized layout for the A.W.671 passenger bus, taking 130 passengers.

In order to maintain the floor at constant level during loading operations, a hydraulically actuated support stay will be incorporated in the rear fuselage and oleo locking will probably be provided for the main undercarriage legs.

The main A.W.650 model on the stand is set up with two lorries which at intervals back up to the two loading doors and pass their loads smoothly into the freight hold. Significantly, this model bears B.E.A. markings, "by permission of B.E.A." The A.W.670 coach, with its curious "bug-eye" windscreen structure, has Silver City markings, also by permission.

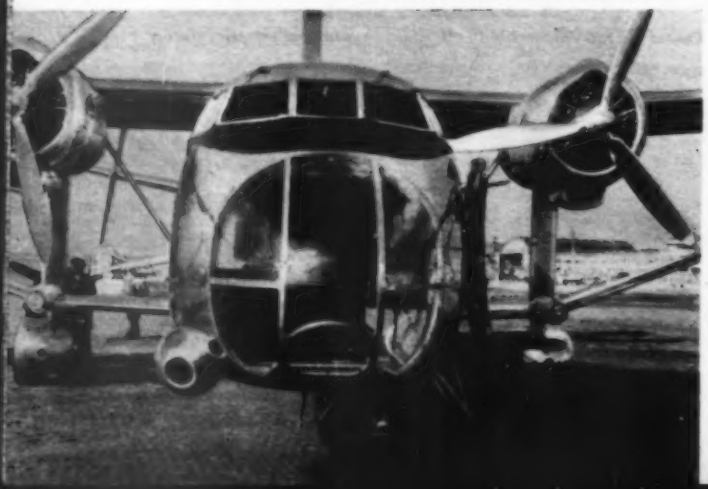
The first A.W.650 should fly in October 1958. Freight hold measurements are: gross volume, 3,680 cu ft; floor area, 426 sq ft; length, 46ft 8in; floor width, 10ft; maximum cabin width, 11ft 8in; maximum cabin height, 8ft 9in; minimum cabin height, 6ft 8in. Rear and front loading doors measure 6ft 8in by 8ft 8in wide. Gross weight is 82,000 lb and maximum payload 28,000 lb. Cruising speed ranges from 276 m.p.h. to 296 m.p.h. at 20,000ft. Maximum range without reserves is 3,000 st. miles and take-off field length for the engine-cut case is 4,050ft. Payload and range, allowing fuel reserves, varies from 500 miles and 28,000 lb to 2,000 miles with 17,500 lb. Seating capacity varies, according to seat pitch, between 71 (38in pitch) and 83 (32in pitch).

Avia 14. The Czech national aircraft industry, directed by the Ministry of Machinery, is now producing a number of civil aircraft; and these, together with a range of engines, are being shown at Paris by the export company Omnipol.

The Avia 14 is the Czech equivalent of the Russian Il-14, and there are only minor differences between the two. The Avia 14 is offered as a medium- and short-range airliner for 24-, 28- and 32-passenger layouts, or as a luxuriously appointed executive machine. Gross weight is 38,000 lb and payload 5,605 lb. Two M 82 T two-row, 14-cylinder direct-injection engines, each giving 1,900 take-off h.p. and driving constant speed four-blade propellers, give a power loading of 9.9 lb/h.p. Cruising speed is 199 m.p.h., service ceiling 22,000ft and range with navigational reserves 1,243 miles. Take-off and landing runs are respectively 1,476 and 1,804ft.

The Avia carries duplicated radio, radio compass, radar altimeter, omni-range equipment, I.L.S.-type approach aid, and autopilot. Standard 12V D.C. and 115V 400 c/s A.C. current are used. Flying controls are manual, with electric aileron and rudder trim. Eight fuel tanks carry a total of 770 gal. Full cold-weather operating equipment is provided and the makers offer the aircraft with a very thoroughly selected set of spare parts and servicing tools.

Offset nosewheels are but one uncommon characteristic of the H.D.34 survey aircraft. Powerplants are 1,500 h.p. Wright Cyclones.



Boeing 707 Stratoliner. A superb and extremely expensive Fiberglas model of the 90-plus-seater Boeing 707-120 is the central (and almost only) feature of the Boeing stand.

Convair 880. All the American jet transports show a remarkable similarity of outline. The 880 models are true to form, and quite as beautiful as the others. Like the other companies, Convair have made extensive comparisons between the jet and piston-engined flight times over the various major world airline routes. Apart from this, however, there is surprisingly little to be seen on the stands of the very large American aircraft manufacturers.

Douglas DC-8. A very fine DC-8 model on the Douglas stand is complemented by another one on the stand of the French Government communications service. Both models are from the same moulds. Douglas show a pictorial comparison of flight times over many of the inter-capital stages for present-day airliners and for the DC-8.

H. D. et M. (Aviation), Ltd. projects. The first H.D.34 photographic survey aircraft (for the French National Geographic Institute) and the little H.D.M.105 are both at Paris. On the company's stand models show the layout of the H.D.321 40-passenger transport and the H.D.34, while another model represents the new H.D.M.106 layout.

Eight H.D.34s have been ordered; and the second machine should make its first flight during the show. There is a possibility of a further order for four more. No H.D.32s or 321s have been firmly ordered. The H.D.M.106 generally combines the features of the high-aspect-ratio wing with the layout of the older Merchantman. It should thus be able to offer remarkably good performance carrying a saloon car, or 15 passengers, livestock, stretchers, general freight or a photo-survey installation. The Lycoming 340 h.p. supercharged or 290 h.p. unsupercharged engines have been chosen as being light and of small frontal area. The aircraft is designed for simplicity and long life, and its particular performance characteristics make it well suited for such military applications as assault transport or parachuting. Many of the components have been proven on previous Miles aircraft. A price of £30,000 is quoted for H.D.M.106s in limited production. A rather larger version powered by two Turboméca Bastans has the designation H.D.M.108.

With the unsupercharged Lycoming 290 h.p. engines, H.D.M.106 performance is as follows: cruising speed at 5,000ft with 50 per cent power, 122 m.p.h.; minimum stalling speed, 64 m.p.h.; single-engine rate of climb, 300ft/min; service ceiling, 17,440ft; take-off distance to 50ft, 700 yd on grass and 580 yd on concrete; landing distance from 50ft, 390 yd (grass) and 365 yd (concrete). Range with 15 passengers is 210 st. miles with standard allowances; and for a 200-mile stage-length and utilization of 2,000 hours a year, V.F.R., the operating cost is 21.5 pence/ton mile.

Max Holste Super Broussard MH-250. Following the great success of the Broussard, the Super Broussard seems to have an already assured future. Ten are to be built straight away, two of them being retained for development and demonstration. The others are already committed by orders from U.A.T., T.A.I. and C.C.T.C. Royal Air Maroc. The first flight should be in June next year. A complete fuselage mock-up is on the Max Holste stand.

A major feature of the MH-250 is that it is intended from the outset to take either Pratt and Whitney R-1340s of 600 h.p. or turboprops of equivalent power (Turboméca Bastans). All piping and control runs are adaptable to either powerplant, and the change-over can be made with the minimum of modifications. Despite its bush-flying operational rôle, the MH-250 is provided with autopilot (Sperry AL-30) and complete radio and blind-flying equipment. The retractable undercarriage is another unusual feature in such an aircraft.

Empty equipped weight is 8,851 lb and gross weight 14,603 lb. As a freighter it can carry 4,121 lb of cargo. For passenger work the cabin can be arranged for 14-17 people with toilet or 20 without. Large side-doors at the rear allow loading of bulky freight, and mixed freight/passenger layouts are possible. A separate large entry-door is located beside the co-pilot's seat.

Full performance and cost figures are now available. Take-off distance to 50ft, with flaps at 30 deg, is 1,050ft and the equivalent

landing distance 1,610ft. Cruising speed at 9,000ft and 55 per cent power is 151 kt. Minimum stalling speed is 55 kt. Maximum and normal range with allowances are respectively 1,062 and 524 n.m. For an annual utilization of 3,000 hr the operating cost is given as 2.5 pence/passenger n.m. when flying 497-mile stages and 3.1 pence/passenger n.m. with 155-mile stages.

Fokker F-27 Friendship "De-Luxe" and Freightship. The handsome second prototype of the Friendship is at Paris while the third machine is reported to be taking shape rapidly at Schiphol. With considerable orders already placed, for both Fairchild- and Fokker-built machines, Fokker are now offering some new alternative versions. One is a cargo or mixed-load version, appropriately called the Freightship. As an optional powerplant for this machine Fokker are offering the more powerful Rolls-Royce Dart RDa.7, giving 1,800 s.h.p., instead of the 1,600 s.h.p. RDa.6. The Freightship has a forward door increased in size to 95in width and 70in height and divided into two sections. Power-operation is offered for this new door. Sliding rails and floor strips ease loading of medium-sized vehicles such as the Land-Rover; and the floor panels are tough and easily cleaned and repaired. Protection for the cabin fittings is provided and the luggage racks fold down out of the way. The whole cabin can be rapidly converted to 40-, 36-, 32-, or 16-seat layout.

With the more-highly-powered Darts, the gross weight is increased to 35,700 lb and the maximum zero fuel weight is up by 100 lb. Cruising speed goes up to 302 m.p.h., and single-engined ceiling to 16,000ft. The engine-out take-off performance is better, but the normal landing and take-off runs are very slightly increased.

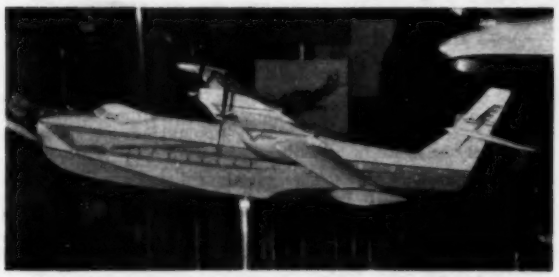
The other new Friendship is the "de-luxe" version, intended as a V.I.P. transport. The Dutch Government has already ordered one for the use of the Royal Family. It is a Fokker boast that the Friendship is one of the safest twins in the world (thanks largely to Rolls-Royce). Fokkers offer special executive interiors to customer requirements, or a three-compartment layout with an office, rest room and cabin accommodation for a total of ten to 16 people. Wardrobe, luggage compartment, two toilets and galley are all included. This is the type of executive layout which has already attracted strong interest in America. The Friendship offers a very useful 275 m.p.h. cruising speed at 20,000ft; pressurization; and a range, with full allowances, of 1,415 st. miles.

A new variant, primarily for military use, is the Troopship. It has large rear-loading doors and is described on p. 738.

Interior of Max Holste Super Broussard mock-up.

Morane-Saulnier Comte de Nice. A cut-away model on the stand shows a swept-wing, four-jet, eight-seat executive aircraft with a high T-tail similar to that of the Paris. Enquiries show that this is as yet purely a design-study and that there is no official support. The wing is swept 30 deg; the engines are four Turboméca Gabizos in pods; a portion of fuselage near the wing-root, aft of the cabin, is apparently occupied by fuel tanks; and the crew compartment is arranged for two pilots. In almost every way the aircraft is like a scaled-down Boeing 707 or Douglas DC-8—and very handsome at that.

Sud Aviation Caravelle. Both aircraft being otherwise engaged, the Caravelle is being shown as a full-scale fuselage mock-up, sumptuously furnished for airline work. Sud Aviation, who are fully aware of the importance of good decor in demonstration



Model of the Piaggio P155X flying-boat—transport derivative of a military design (p. 739) with a hull reminiscent of the Saro P.162.

work, have reported very favourably on the reactions of those who have seen the second aircraft during its American tour. The intensive sales campaign continues and orders are expected to be announced in the near future.

LIGHT AND UTILITY AIRCRAFT

Czechoslovak Industry Ld 60 Agricolta (Brigadyr). This machine went into production at the end of 1956 and about 50 have now been built. One of them is at the show. In many ways it resembles the Fieseler Storch, but it is all-metal. Power is provided by a Praga Doris B engine of 220 h.p.

The Agricolta, which has double-slotted flaps and single-slotted ailerons, together with retractable slats, is equipped with a full blind-flying panel, radio, and electrical services for night flying. The tailplane is variable in incidence, and a glider- or banner-towing attachment, located in the end of the tail-cone, is standard. Span, length and height are respectively 45ft 10in, 28ft and 8ft 10in. Wing area is 261 sq ft. Gross weight and useful load are 3,020 lb and 1,180 lb respectively. Range, at 3,280ft is 435 miles; cruising and minimum speeds are 112 m.p.h. and 34.2 m.p.h. respectively. Landing and take-off distances, from and to 50ft, are 591ft and 738ft.

Czechoslovak Industry Ld 40 Metasokol. In addition to showing the now well-known Super Aero and Trener 6, the Czech agency Omnipol is exhibiting the little Ld 40 all-metal touring and club aircraft. Powered by the excellent 105 h.p. Walter Minor 4-III with variable-pitch propeller, the machine is, in fact, the all-metal successor to the earlier Sokol types. The retractable undercarriage has its third wheel level with the trailing edge of the wing and steered from the rudder pedals.

The following performance and dimensional data are given: Span, 32ft 10in; length, 24ft 7in; height, 6ft; wing area, 156 sq ft; empty and gross weights, respectively 936 lb and 1,874 lb; max. speed, 143 m.p.h.; cruising speed, 127 m.p.h.; landing-speed, 43.5 m.p.h.; service ceiling, 16,400ft; range, 621 miles; take-off run, 722ft. The prototype is shown at Paris and production is expected to start at the end of this year.

Dornier-Werke Do 27B. First designed and built in Spain as the Do 25, the Do 27 is now well established in Germany (428 are being built for the Luftwaffe). The example in the static park, a Do 27B (290 h.p. Lycoming) built at Munich, is very well finished and furnished. The cantilevered wing carries fixed slots over the whole leading edge and double-slotted flaps and ailerons. The airframe is remarkable for its economy of structure, a single frame carrying the wing loads through to the floor which, with two strong longerons at the ten and two o'clock positions, forms the cabin section. The after fuselage is monocoque. Access to both pilots' seats and the main cabin is made easy by four very large doors. Long-stroke oleos carry large-tyred wheels with hydraulic disc brakes for the main undercarriage, while

A typically Italian contribution is the FN-333 amphibian.

THE PARIS SHOW...

the tailwheel has a solid tyre. Separate seats for the pilots and a bench seat to the rear still leave ample space for the remainder of the 1,433 lb disposable load. Equipped and gross weights are respectively 2,292 lb and 3,527 lb.

Max Holste M.H.1521 Broussard. Altogether about 500 of these excellent bush aircraft have been ordered, 335 of them for the French Air Force. Production is now in process of being increased to about ten per month and civil orders are being filled. A French military Broussard equipped with a command radio installation is displayed in the static park.

Nardi FN 333. Fiat are building the first Nardi amphibians and test flying is continuing with the second prototype. One machine, brought to Paris by surface transport and displayed in the static park, has tiny bullet-shaped retractable floats and a retractable nosewheel undercarriage. The engine is a Lycoming 180 h.p. pusher. Of all-metal structure, the FN 333 has a small three-/four-seat cabin and slender twin booms. All engine-cooling air is drawn in through two intakes in the wing root and dumped by the ejector exhausts. The long boat-shaped hull carries a retractable water rudder at the back. Main characteristics are: span, 33ft 11in; length, 23ft 11in; empty weight, 1,962 lb; gross weight, 2,970 lb; top speed, 180 m.p.h.; ceiling, 19,685ft; maximum range, 776 miles; and water take-off run, 1,385ft.

HELICOPTERS

Agusta. Illustrated here is a model 47J of the type now being manufactured under Bell licence. A total of well over 200 Bell 47s has now been delivered by Agusta to many countries.

Fairey Rotodyne. The date for the first flight of this aircraft is now approaching and the company has released some new information on the machine in a brochure on the stand. The Rotodyne is, of course, designed to carry 40 passengers or 9,000 lb of freight over stage-lengths of 300 miles, and to illustrate the usefulness of this performance Fairey show a map of a route from Puerto Rico to Trinidad *via* the West Indies and Barbados. In such areas the machine's useful load and small-airfield requirements would make it very attractive. Equally telling is a proposal for a route network in British Columbia, where mining and hydro-electric undertakings would enormously benefit from transport support in the form of Rotodyne services.

Fairey are now also offering the larger fuselage of the military Rotodyne for civil use. Thus the seating capacity can be raised to 48 and carriage of such items as cars is facilitated. The convertible passenger/freight cabin layout is considerably assisted by the Rotodyne's wide range of c.g. travel.

Avtur or Avtag fuel may be used. The tare weight is 24,030 lb and the maximum disc loading (at 39,000 lb) is 6.14 lb/sq ft; tip speed at take-off is 720 ft/sec. The engines are Napier Eland NEl.7s, giving 3,500 h.p. at 12,500 r.p.m.

Polish Industry SM-1. Now built in Poland, this design corresponds to the Russian Mi-1 helicopter. It is a three-seater powered by an AI-16W seven-cylinder radial engine giving 575 h.p. at 2,200 r.p.m. and 430 h.p. normal continuous power. Gross weight is 4,960 lb and maximum and cruising speeds are 124 m.p.h. and 87 m.p.h. respectively. Sea-level rate of climb is 1,280ft/min and times to height are given as 4 min to 3,280ft, and 12 min to 9,843ft. Hovering ceiling is 16,400ft and range is 239 miles. The machine shown has normal blind-flying instruments, but is equipped with a Russian radio altimeter and liquid de-icing for the rotor blades. The fluid is pumped into the blade leading-edge and leaks through small perforations in the leading-edge metal skin. The main rotor has three blades

Sud Aviation Alouette. The new versions of this machine were announced just before the show started. One is the executive four-seat Alouette Gouverneur and the other a Turmo II version, designated S.E.3140. The advantage of the Turmo installation is the free turbine drive, which will offer better flexibility of operation. Jump take-offs will be possible without straining the transmission. The Gouverneur is sumptuously furnished for four people (instead of the usual five) and the fuselage is covered and streamlined. This carries a weight penalty of 132 lb but gives a 15.5 m.p.h. increase in cruising speed, as well as greatly enhancing the appearance of the machine.

Both military and civil production is progressing very rapidly, Bréguet helping to produce transmissions. There are six or seven Alouettes at the show, all flying intermittently, and models in the static display illustrate the various layouts which can be used for ambulance, missile launching, cargo-sling carrying, waterborne and several other rôles. Between 80 and 90 Alouettes of all kinds have now been built, most of them for the French forces.

Sud Aviation Djinn. Production of the Djinn, for both military and civil customers, is proceeding apace; so far 36 have been delivered. Military utility and civil agricultural versions are on show, and models on the stands show various adaptations for stretcher-carrying, missile-firing and other military duties.

Production Djinns have a redesigned rotor head much smaller and lighter than that of the earlier aircraft, and the root structure of the blades has been covered with a very-wide-chord aerofoil cuff which provides a useful increase in lifting power.

Vertol 44 and H-21. French Air Force, U.S.A.F. and American civil versions of this machine are at Paris. Some of them are running a shuttle service between Issy airfield (in south-west Paris) and Le Bourget. The flights follow the Seine, for safety reasons, and single fare is 5,000 francs (nearly £5). On the Vertol stand there is a complete series of models showing the machine in the colours of the arms and air forces which use it. They include the R.C.A.F., French Navy and Luftwaffe.

Westland Westminster. A wealth of new information is available on the Westland stand and is supported by models. The Westminster is to fly initially with a steel-tube fuselage which will act simply as a dimensionally accurate frame for the powerplant and transmission sections of the definitive transport. But this utility version will also be offered for use as a flying crane. It will be fabric covered. Of the three Westminster models on the stand, one is the utility and carries a field gun slung beneath it; another shows the military version; and the third is a civil machine bearing, significantly, Aer Lingus markings.

The main transmission, rotors and duplicated hydraulic control

The Super Aero, with the Avia 14 and Broussard also in the picture.

One of the latest Bell helicopter designs, the 47J is now in full production in Italy by the Agusta company.

A brilliant performer on Sunday was the Dornier Do27.

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system of the American Sikorsky S-56 are retained, but the outrigger-mounted piston engines are replaced by two Napier Eland NEl.5s mounted side-by-side over the cabin and driving directly into the main transmission gearbox. The greater smoothness of these engines will allow a gearbox overhaul life of 1,000 hr. The all-metal rotor blades, built up from extruded spars and having honeycomb-stabilized trailing edges, will offer a fatigue life of 2,000 hr. Hot air de-icing for both main and tail rotors will be available. A simple fixed undercarriage replaces the retractable gear of the Sikorsky S-56.

The Westminster cabin will be 35ft long and 6ft 6in high and have a maximum width of 10ft, giving a cabin volume of 1,780 cu ft. Two loading doors will be provided and the floor will be stressed for concentrated loads. Jury struts are to transfer loads from the 15,000 lb sling directly to the rotor mounting platform to avoid stressing the fuselage during flying crane operations. The fuel load will be 920 Imp. gal and military load 43 fully equipped troops, 31 stretcher cases, or four jeeps in the sling.

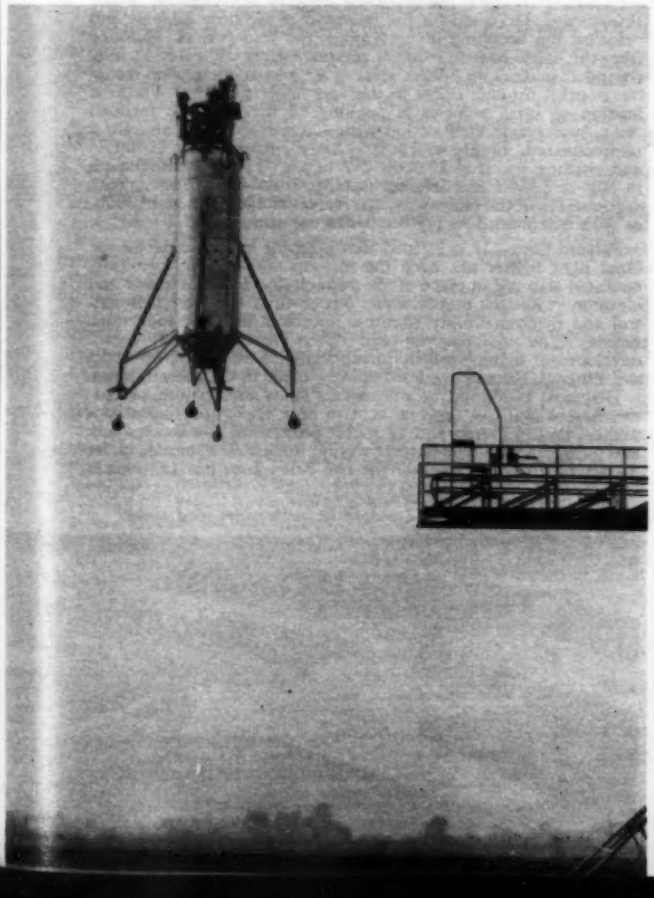
Empty weight of the Westminster will be 20,000 lb, disposable load 13,000 lb and gross weight 33,000 lb. The overload weight will be 36,000 lb. At normal gross weight it will have a single-engined rate of climb of 600 ft/min. Cruising speed will be 150 m.p.h. A 500-mile stage will be flown in 3.3 hours, with a 5,400 lb payload. A load of 10,300 lb can be carried 150 miles.

Main dimensions are: rotor diameter, 72ft; overall height at main rotor, 18ft 4in; maximum overall length, 86ft 9in. The allowable c.g. range will be no less than 24in.

RESEARCH

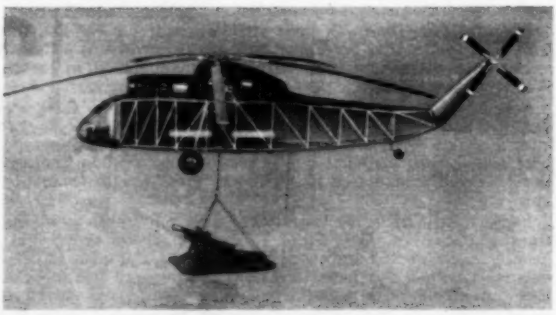
S.N.E.C.M.A. Atar Volant. Remarkable progress in the development of this type of VTO machine is now aimed directly at producing very-high-performance intercepters of the coleopter type. The company has the licence for this annular-wing layout from the inventor, Dipl. Ing. Von Zborowski, and construction of the first machine is already under way. First on fixed and then on moving benches, and then in special free-flight test rigs, S.N.E.C.M.A. have developed special VTO Atars, thrust-deviation devices and an autopilot since work began in 1954.

Fortunate visitors are taken to see this piloted S.N.E.C.M.A. Atar Volant C-400 P-2 V.T.O. research vehicle.



The Alouette Gouverneur makes its debut in the executive class.

Licensed from Russia is the Polish SM-1 helicopter, now in production.



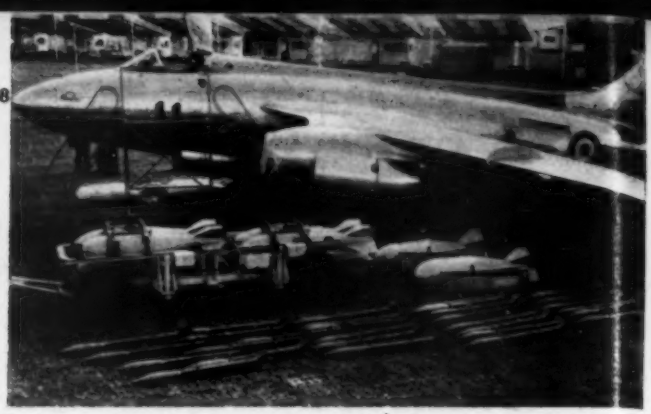
This "flying crane" Westminster model is a Westland attraction.

Now they have flying the C-400 P-1 remote-controlled Atar Volant and the piloted C-400 P-2. The latter first performed entirely independently on May 14, flown by Auguste Morel, and will be demonstrated at Le Bourget this weekend.

Built round an Atar DV of 6,393 lb thrust, the P.2 weighs 5,732 lb. This includes 1,102 lb of fuel (about 140 gal), which gives it a safe endurance of just over four minutes. The quantity is so small because the P-2 is in fact only the centre-body of a coleopter, fuel for which would normally be carried in the annular wing. In addition to carrying fuel and providing lift, the wing would form the shell for a ramjet. Speeds of the order of Mach 2 to 3 are forecast. Occupying an ejection seat perched on top of the P-2, the pilot has a power lever and a tiny four-way switch as his sole controls. Normal artificial horizon, turn-and-slip indicator and altimeter are carried, together with (to assist in landing) an extra-sensitive pressure altimeter indicating changes of height of only a few inches.

Vertical control is by variations of power, and jets of compressor-bled air are used to deflect the main efflux for lateral control. Four pipes are led out along undercarriage struts and set to provide a turning moment in the horizontal plane. An electronic autopilot designed by S.N.E.C.M.A. takes care of all short-term stabilization, using attitude-displacement signals from two gyros. Rate gyros sense lateral accelerations to give automatic drift correction in gusty conditions. This is necessary for vertical landing. The P-2 nacelle is 19ft 8in long and 59in wide; and the pilot sits some 23ft from the ground.

The C-400 P-3 will have the more powerful Atar EV, an enclosed cockpit and a tilting ejection seat to allow for transition to horizontal flight. Without the annular wing, the P-3 will still be limited to vertical flight, but transition to horizontal flight will be reproduced by mounting the machine on a special platform. Further vertical Atars, some with afterburners, will be developed and then coleopter construction will start in earnest. S.N.C.A.N. are making the airframes.



French progress in aerodynamics, structures and armament is typified by the S.E. Durandal intercepter and the S.O. Vautour attack aircraft.

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MILITARY

Air Fouga C.M.175 Magister Marine. There is an order (on behalf of the French Navy) for 30 of these navalized Magisters in addition to contracts for 350 of the original land-based machines. The redesigned canopy has had the unforeseen effect of appreciably reducing stalling speed and the new long-stroke undercarriage is said to be particularly pleasant. The arrester hook and other naval gear have lowered the top speed by the merest margin. Grumman have the American licence.

Bréguet 765. This military version of the familiar Deux Ponts (one of the 15 ordered for the French Air Force is on show) carries up to 150 men. A repeat order is expected.

Bréguet 1001 Taon. A light attack aircraft for NATO, this trim-looking Orpheus-powered single-seater (shown as a model) is designed to operate from strips less than 5,200ft in length. Weight is about 5 metric tons and length 37ft.

Bréguet 1100 Taon. This twin-jet variant of the Taon was designed to a French Air Ministry specification and the Navy are interested—to the point, at least, of having ordered a prototype. The two Gabizo turbojets suit it for medium-altitude interception. Length is increased to 41.3ft and gross weight to about 6 metric tons.

Bréguet 1050 Alizé. At least 100 of these naval anti-submarine three-seaters (R-R. Dart 21 of 1,975 h.p.) are on order. Four have been completed and three have flown. Catapult trials have been successfully concluded at R.A.E., Bedford. The two crewmen (additional to the pilot) can change seats to avoid radar eyestrain. The propeller is a Bréguet BR.4 (Rotol licence) and principal data are: span, 51.2ft; gross weight, about 17,600 lb; patrol speed, 130-230 kt; endurance, over 4 hr; range, about 1,550 miles. Two types of airbrake are being tried on the aft fuselage.

Bréguet Integral. Test-running continues on the wing of the first 940 Integral STOL aircraft, but the fuselage is also under construction and the first flight should take place by the end of the year. Models on the stand show considerable development of the Integral. The small engine for steering at low speeds has been replaced by a large twin-finned vertical tail layout. The four Turboméca Turmo II turboprops are in separate nacelles, but cross-shafting directly couples all engines to cater for the engine-out case at low speed, when a great deal of the lift is provided by slipstream. Very large double flaps cover the whole trailing edge and all sections move to provide aileron control. Large-diameter propellers keep the whole wing inside the slipstream. The Integral will weigh 14,300 lb and span and length will be respectively 58ft 4in and 40ft. Take-off distance varies between 33ft with 2,640 lb load to 328ft with 6,160 lb. Landing run is 120ft and minimum speed 28 m.p.h. Maximum cruising speed is stated to be 240 m.p.h. Further development is in hand to produce an Integral with supercirculation over the flaps. Wheel or skid undercarriage will be optional.

The full-scale operational development, designated Bréguet 941 and powered with four General Electric T58 turboprops is illustrated, in model form, on page 740.

Dassault Super Mystère SM.B2. Figures quoted for this fighter/bomber, powered with an Atar 101G2 turbojet and flying at an all-up weight of 19,850 lb, are cruising speed, 620 m.p.h.; max. speed, 745 m.p.h.; rate of climb (height unspecified), 15,700ft/min; endurance, 1 hr; ceiling, 55,500ft. A total of 370 are on order in addition to the original prototype and five pre-production aircraft. The first prototype now has a dog-tooth wing (as shown also on models of the Etendard).

Dassault Etendard IV. This fighter/attack prototype, powered with a S.N.E.C.M.A. Atar 101E4, flew on July 24 last.

Dassault Etendard VI. The first prototype of this version of the Etendard—powered with a Bristol Orpheus turbojet—flew on March 15 last, and the second and third examples (all are being built to the NATO programme) are under construction.

Dassault Etendard IVM. The "M" in this designation signifies Marine, the aircraft being intended as a carrier-based fighter for the French Navy.

Dassault Mirage I. Powered with two Dassault M.D.30R Viper turbojets plus an S.E.P.R. 66 rocket, this single-seat intercepter flew on June 25, 1955.

Dassault Mirage III. This version of the Mirage intercepter has a S.N.E.C.M.A. Atar 101G1 turbojet and S.E.P.R. rocket and flew on November 17, 1956. It has recently exceeded Mach 1.5 in level flight with full war load and, when it receives an Atar 9 of over 13,000 lb thrust, should attain Mach 2.

Dassault Mirage IV. An aircraft of this designation is classified by the makers under "research and development." Extremely high speeds are rumoured.

Fiat G.91. NATO patronage still prevents Fiat from releasing any detailed information on this light attack aircraft. A model shows that it now has an under-fin, and mention is made of a G.91R photographic reconnaissance variant. In addition to the gun-armament offensive stores can be carried in the fuselage and beneath the wings.

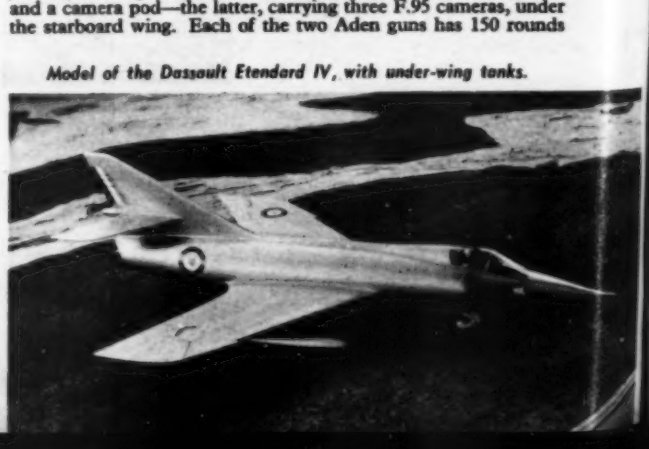
Fiat G.91T. So designated is a proposed tandem-seat trainer variant of the G.91. The intended turbojet is the Bristol Orpheus BOr.4 and gross weight is quoted as 11,000 lb. Maximum level flight speed should be about 650 m.p.h. and endurance 1 hr 40 min. Designed diving speed is 680 m.p.h. (indicated) or better than Mach 1.06.

Fokker Troopship. What better name than Troopship could have been conferred upon the proposed military development of the Friendship? Designed for the transport of airborne infantry and vehicles, the dropping of paratroops, the transport of wounded from the battle zone to medical centres, etc., it will carry 54 fully equipped soldiers on bucket seats or 42 paratroopers, who would be dropped through doors in the rear lower fuselage. The rear loading of small vehicles is possible by means of an inclined ramp, working in conjunction with a screwjack. The aircraft is unpressurized. Empty weight is 21,830 lb, gross weight 35,700 lb, and cruising speed at 10,000ft 297 m.p.h. Take-off field length to 50ft is 2,530ft and landing distance from 50ft 1,830ft. With maximum load the range with no reserves is 470 miles at 10,000ft, or with maximum fuel 1,340 miles at the same height.

Folland Gnat. It is learned that a recent modification on the Gnat light fighter has been the introduction of a hydraulically operated slab tail in place of the variable-incidence tailplane and elevator. This, the makers state, has ensured that excellent control and manœuvrability continue unbroken into the supersonic region. The modification—and others resulting from recent development flying—will be incorporated in the Gnats for India and Finland. First deliveries should be made in the early autumn.

Diagrams published by the makers show these combinations: two bombs and two drop tanks; two drop tanks and rocket projectiles; no drop tanks and 12 rocket projectiles; and a drop tank and a camera pod—the latter, carrying three F.95 cameras, under the starboard wing. Each of the two Aden guns has 150 rounds

Model of the Dassault Etendard IV, with under-wing tanks.



of ammunition; that is, sufficient for about six seconds' firing. Cabin pressurization starts at 15,000ft and maximum differential is 3½ lb/sq in at 40,000ft and above. Standard equipment is one multi-channel V.H.F. transmitter/receiver, with single-channel stand-by and tele-briefing, radar ranging, I.F.F. and a radio compass or other navigation aid.

At full load the intercepter Gnat requires 760 yd to clear a 50ft screen under tropical sea-level conditions, and under the same conditions the tactical version requires 1,375 yd. The same take-off performance is attained in temperate conditions from an airfield at 5,000ft altitude.

It is officially stated that a thinner—6 per cent—wing has already been designed and that this, coupled with up-rated versions of the Orpheus, will give "full supersonic capabilities". To these may be added A.I. equipment and guided weapons (as an alternative to the two Aden guns). Mention is made in a brochure of Gnat "supersonic Mk 2 and Mk 4 developments".

Hispano HA-200-R1 Saeta. This resourcefully designed Spanish tandem-seat trainer bears the flags of the numerous countries in which it is being demonstrated. It is powered by two Turboméca Marborés and was designed under the direction of Professor Willi Messerschmitt. It uses many of the components of the HA-100 piston-engined trainer.

Hurel-Dubois H.D.341. The H.D.341 is an armed-patrol and police version of the H.D.34, and is also considered to be particularly suitable for the putting down and picking up of agents, and for other "special" missions. The crew is two pilots (one a forward machine gunner), observer, radio operator and two aft gunners; and armament is four 12.7 mm guns forward, two 7.5 mm guns aft, and eight rocket projectiles attached to the characteristic Hurel-Dubois wing-bracing struts. An endurance of 28 hr is possible. When equipped to carry 60 armed soldiers the aircraft can cover a distance of 430 miles, land on a 300-yd unprepared strip, take off and return to base without refuelling.

Morane-Saulnier M.S.1500 Epervier. Details are given of this new light army co-operation and ground-attack aircraft, a prototype of which is under construction. The picture of a model on the right shows that it is of elementary design, with fixed undercarriage and forward-placed cockpits, giving an exceedingly fine field of view over the nose-mounted Turboméca Bastan turboprop. There are fittings for machine-guns, bombs, R.P.s or guided missiles, and liberal armour protection is provided. Internal kerosine can be supplemented by external tanks, which increase the endurance at 10,000ft from 4 hr to 7½ hr. Other data are: span, 42ft 1in; length, 33ft 3in; gross weight (without external tanks), 5,500 ib; gross weight (with external tanks), 6,000 lb; max. level speed, 206 m.p.h.; rate of climb at s.l. (max. continuous r.p.m.), 1,700ft/min; take-off run to clear 50ft, 820ft; landing run from 50ft, 790ft.

North American NAA-249. One of the most attractive models in the whole show is that showing this "jet training system". The makers give as its functions orientation, check-out, aerobatics, navigation, instrument flying, night flying, formation flying, pilot proficiency, gunnery, rocketry, bombing and target-towing. Particular attention has been paid to maintenance and waist-level access may be had to all major systems and equipment. Removal of the complete turbojet—a Westinghouse J34 or Bristol Orpheus —is possible in under 20 min. Gross weight is 9,480 lb.

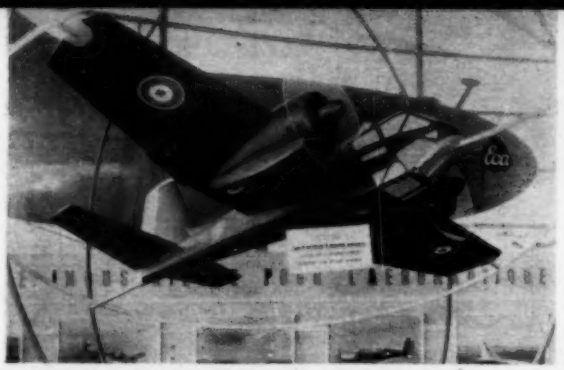
Piaggio P.155. Models show two military versions of the P.155 amphibian, a civil edition of which is illustrated on page 735. The SAM.1 is an air/sea rescue version with two Pratt and Whitney R-2800 piston engines, and the P.155AS is a turboprop-powered anti-submarine version. The SAM.1 would accommodate 20 "rescuees".

Polish Industry Bies TS-8. This machine is a tandem-two-seat trainer with retractable undercarriage and powered by a Polish WN-3 seven-cylinder radial engine of 320 h.p. Last December it set up an international height record for Class 1-c aircraft of 7,084 m. In May it added to this the closed-circuit distance record of 2,883 km. The workmanship of the skinning leaves a little to be desired and access over the fabric-covered flaps, though assisted by good handholds, appears a little awkward. Never-exceed speed and cruising speed with 75 per cent power are respectively 310 m.p.h. and 167 m.p.h. First-class manœuvrability was demonstrated over Le Bourget last Sunday.

Potez 75. It will be remembered that this sturdy piston-engined pusher monoplane was originally intended as a specialized anti-tank aircraft, but it is now in production—to the extent of 100 machines—as a light ground-attack aircraft for colonial service. Fifteen pre-production aircraft are being built in addition to the prototype. The normal built-in armament is four machine-guns, and the crew of two have heavy armour-protection. Nord S.S.11 missiles are optional armament.

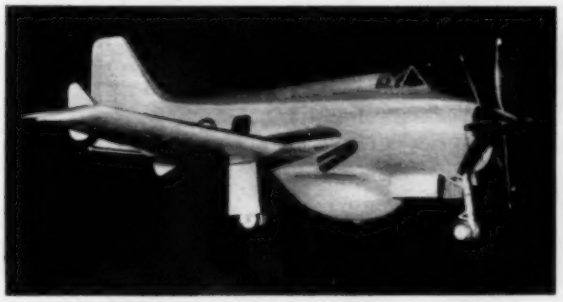
Potez P.91. An artillery observation aircraft powered with a Potez 4D30 engine.

Sipa S.1100. In appearance and purpose the S.1100 is strongly reminiscent of the pre-war French *type coloniale* machines.



S.I.P.A. 1100 twin-engined multi-purpose aircraft (model).

Morane-Saulnier M.S.1500 light ground-support aircraft (model).



Fairey Gannet A.E.W.3 early-warner (model).

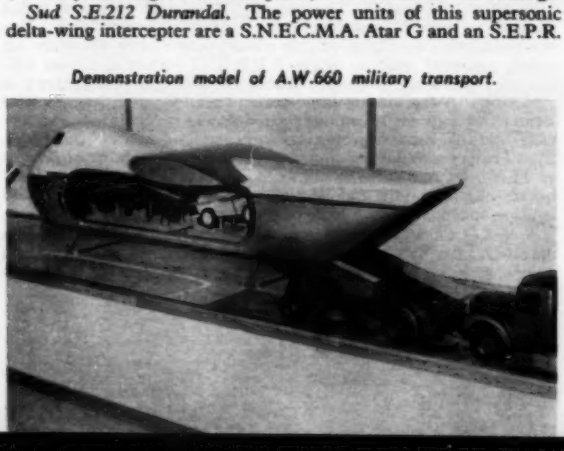
Powered with two Pratt and Whitney R-1340 engines, it is a shoulder-wing monoplane with generously glazed nose and is suitable for ground attack, photography and reconnaissance. A model is shown at the head of this page.

S.N.C.A. Nord 1405 Gerfaut II. This development of the Gerfaut I first flew on April 17, 1956, and has since established world's climbing records (3,000 m in 51 2/10 sec; 6,000 m in 1 min 17 2/10 sec; 9,000 m in 1 min 34 sec; 12,000 m in 2 min 18 sec; 15,000 m in 3 min 56 5/10 sec.) The engine is a S.N.E.C.M.A. Atar G. Empty weight is 9,038 lb and gross weight is 11,680 lb. Ceiling is over 55,000ft. A Gerfaut IV, with Atar 9, is reported.

S.N.C.A. Nord 1500 Griffon. Powered with a S.N.E.C.M.A. Atar turbojet and a ramjet, the second prototype of this remarkable canard intercepter made its first flight on January 23 this year. A model shows a developed version to have small anhedral fins (virtually forming a small tailplane) at the rear of the fuselage.

Sud S.E.212 Durandal. The power units of this supersonic delta-wing intercepter are a S.N.E.C.M.A. Atar G and an S.E.P.R.

Demonstration model of A.W.660 military transport.



Model of Breguet 941 STOL (T58 turboprops).

Good handling qualities were demonstrated last Sunday by this Polish TS-8 Bies piston-engined trainer.

A Spanish offering is the Hispano Saeta jet trainer.

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rocket. The first flight was made over a year ago and considerable development flying has since taken place. The aircraft can operate in the fighter/bomber rôle with external loads, and a photograph on page 738 shows the Durandal carrying an air-to-air missile under the fuselage.

Sud S.E. Durandal IV. This designation is given for a Durandal development powered with an Atar 9 turbojet (Atar 8 with afterburner) delivering 13,360 lb thrust.

Sud S.E.116 Fonceur. A projected tactical support aircraft with two Turboméca Bastan turboprops.

Sud S.O. Trident II. The loss of a Trident II prototype (pilot Goujon) on May 21 was deeply regretted by all at the Show. Ten pre-production examples of this mixed-power intercepter are on order, powered with a single S.E.P.R.63 rocket and two tip-mounted Turboméca Gabizo turbojets. Mach 2 performance is attainable. A fascinating large-scale model shows a hypothetical Trident II base with camouflaged dispersals, refuelling and servicing points, missile protection and other modern conveniences. The Trident's weight equipped is given as 5,788 lb, gross weight as 11,355 lb, and time of climb to 50,000ft 2 min 30 sec (from brakes-off). Landing and take-off runs are less than 550 yd and landing speed is claimed to be of the order of 100 kt.

Sud S.O.4050 Vautour N. The "N" variant of the Vautour is the all-weather fighter. Its four 30 mm DEFA guns have 400 rounds apiece, and 240 SNEB rockets are accommodated in the bomb bay in addition to a possible four M.116E honeycomb rocket-launchers under the wings. Two of the honeycomb launchers can be replaced by 270-gal drop tanks.

Sud S.O.4050 Vautour B. Internal capacity of this bomber version is one to ten bombs, or "missiles" (an elementary form of guided bomb is shown), or extra fuel. Bombs or missiles or drop tanks can be carried under the wings. There is also the "A" ground-attack version of the Vautour, and reconnaissance and dual-control trainer variants are under development.

Sud S.E.5003 Baroudeur. The S.E.5003 is a version of the earlier S.E.5000 trolley/ski-launched Baroudeur ground-attack aircraft developed for participation in the NATO evaluation tests to be held next month. The Baroudeur can carry two 2,200 lb bombs under the wings and has proved that it can take off from a field on which only vehicles of the Dodge Command Car type can move and that it can land on a field in which these vehicles would be bogged down. Empty equipped weight is 9,600 lb, gross weight (with external load) 14,655 lb, maximum level flight speed 660 kt, time of climb to 30,000ft (clean configuration, excluding take-off run) 1.9 min, service ceiling 55,000ft, take-off distance to 50ft 1,640ft, approach speed 93 kt, landing run 790ft. The rate of roll at 400 kt is 190 deg/sec, and at 33,000ft, at a Mach number of 1.06 (the maximum at this height), it is possible to pull 6g.

ENGINES

AT the last (1955) Salon no fewer than 21 aircraft powerplants were exhibited for the first time. This year there are fewer completely new units; but among the latter are several of singular importance, including two American turbojets which rank among the most important in the world (a fact which heavily underlines the tremendous importance attached to Paris by our commercial competitors across the Atlantic).

Agusta. Although this well-known Italian company have long made engines for cars and motor cycles (as well as over 250 Bell 47 helicopters, *q.v.*) it was only in 1955 that they entered the aircraft-engine field. In that year Sig. Ginnini directed the design of three very acceptable light piston-engines, and testing of prototypes is at present in full swing at the company's works at Gallarate, north-west of Milan.

Smallest of the trio is the G.A.40, a flat-twin of 1.486 litres capacity rated at 42 h.p. at 2,700 r.p.m. and weighing 86 lb. It is being bought in quantity by the Italian Air Force for use in "motorized gliders." The larger engines are both versions—respectively for fixed-wing aircraft and helicopters—of the same flat-four unit of 2.3 litres capacity. The fixed-wing version, designated G.A.70/o, weighs 150 lb and is rated at 72 h.p. at 3,100 r.p.m. The helicopter G.A.70/v is similarly rated and is exhibited devoid of drive, reduction gearbox, clutch or fan, so that the weight is but 147.5 lb.

Alvis. Now in bulk production with both fixed-wing and helicopter versions of the single-row, nine-cylinder Leonides and the two-row, fourteen-cylinder Leonides Major, this Coventry company exhibit a display model of the fixed-wing versions of each.

Armstrong Siddeley. A revelation is the increased rating of 8,800 lb (an improvement of at least 300 lb) of the Sapphire ASSa 12, the high-temperature version of the "first-generation" Sapphire 100-series. An ASSa.12 is exhibited in completely cut-away form, finished to the beautiful standard which one now expects from this company's show engines. The unit on view is equipped as a Javelin powerplant; later (Mk 7) Javelins, and the Victor B.1, presumably have the 200-series Sapphire of 11,000-odd pounds thrust.

Much smaller than the Sapphire is an ASV.9 Viper, rated at 1,900 lb dry (not dissimilar to the Jet Provost's ASV.8, a 1,750-lb engine). As a private venture A.S.M. are going on with increased throughput Vipers in the 2,000-2,460 lb-thrust bracket, using Sapphire experience. The ASV.10 is the first of the new family, giving 2,000 lb at very low peak temperature; the ASV.11 is also a "long-life" engine, rated at 2,500 lb.

Completely new is the exhibit of a gas-turbine air-compressor/shaft-drive power pack by AiResearch (see page 723). The first unit is the GTCP-100, rated at 50 h.p. at 40,000ft and providing cockpit conditioning, bleed air or shaft-power. Production will start at the Parkside works next year, especially upon units equipped as A.P.Us.

Bristol. The Olympus 6, on view, has a type-tested rating of 16,000 lb and is cleared for production at this figure. A variant of the family is listed under *Curtiss-Wright*, mentioned later.

During the course of the Salon new Orpheus figures were revealed: BOr.12 (new rating), 6,810 lb dry, or nearly 8,000 lb with reheat; weights, BOr.2 (4,520 lb thrust), 790 lb; BOr.3 (4,850 lb thrust), 810 lb (thrust/weight ratio of 5.99, the highest revealed for any long-life turbojet); specific fuel consumption, BOr.3, 1.06. Folland revealed that they may use Orpheus in the 6,000 lb thrust class in future Gnats, and North American mentioned the low-temperature Trainer Orpheus as a suitable powerplant for their Model 249 trainer.

Curtiss-Wright. For the first time the Wright Aeronautical Division of this big American corporation have been able to exhibit a cut-away display model of the J65 (Americanized Sapphire). Production of J65s is now into the five-figure region, and the company are studying increased-thrust developments, some similar to the British 200-series engine and some for possible commercial use.

Also on view is a fine cut-away Turbo-Compound. A yellow-painted cylindrical device in one corner of the C-W. stand can at once be recognized as the Wright ramjet (*Flight*, April 11, 1956). Except for having an incorrectly profiled intake centre-body it is authentic, and its accompanying legend states that a unit of similar design made "the world's first successfully controlled ramjet flight on May 7, 1952." The Mach bracket of the family is given as two to four. (Much bigger Wright ramjets drive the Navaho missile.)

A new development is indicated by a placard giving the outline of the Curtiss-Wright all-mechanical r.p.m. control for helicopters. This system involves a speed-sensor, a speed-changer (serving as a power-amplifying integrator) and a second unit serving as a power-amplifier.

Dassault. For several years Marcel Dassault, one of the most successful French aircraft constructors, have held an Armstrong Siddeley licence-agreement in respect of the Viper turbojet. Several French versions have now appeared, and M.D.30 Vipers have flown on a Languedoc and in Tridents and Mirages. A new engine is the R7, scaled up to a mass flow of 55 lb/sec, and rated at 3,000 lb. It first ran last December.

de Havilland. Of the entire Enterprise only the D.H. Engine Company exhibited. Nevertheless their dimensionally correct Gyron with reheat pipe dwarfs every other powerplant which can ever have appeared at any aeronautical exhibition. The accompanying legend points out that the Gyron is "being shown for the first time with an operational reheat pipe and variable nozzle. This engine is now running at 25,000 lb static thrust and has been designed specially for aircraft flying at up to three times the speed of sound."

A welcome newcomer to D.H. stands is a simulated back-end of a mixed-power intercepter, mounting a Gyron Junior (visible) and a Spectre (hidden). Correct end-covers are in position over the orifices. The profile of the rear body and its white finish suggest Saunders-Roe; and a mural depicts a futuristic mixed-power machine with Firestreak missiles on the wing-tips and H.T.P. starter and accessory unit.

Fiat. The Model 4002.000 turbojet is now well known, and an example is on view on the company stand. Alongside it is the redesigned 4002.001, a completely new unit not seen before.

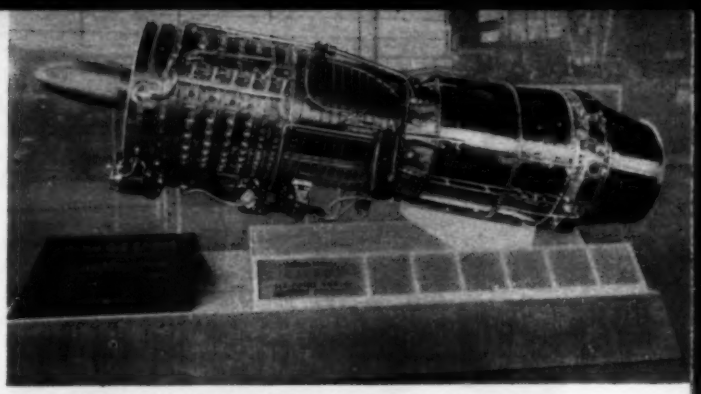
Like its predecessor, the .001 is a simple small turbojet with a single-sided centrifugal compressor and a neat one-piece tubo-annular combustion system. By dint of revising the geometry of the latter—the flame-tube unit, or inner combustor shell, involves a species of reverse flow—an incredibly short engine has been achieved, with an overall length of under 35in. The Nimonic inner combustors of both old and new engines are exhibited separately, and the new design, with 16 almost-hemispherical flame-tubes, is of most unusual configuration. Some basic data (with .000 figures in brackets) are: length 34.9in (40.6); dry weight, 194 lb (220); maximum rating, 715 lb (594), at 25,000 r.p.m. (26,000). Accessory equipment on the 4002s came from Lucas, Kelvin Hughes and Air Equipement.

General Electric. There is some justification in describing G.E.'s J79 engine as the most important advance in gas-turbine technology to have been made since the two-spool naissance seven years ago. We have watched the engine with intense interest for several years (its project date was 1952) and were glad to see "the wraps" finally come off at Paris.

This is not the place for a full chronology of the J79, but it must be explained that it is the first production engine to have multiple variable-incidence stages of compressor stator blading. This allows tremendous flexibility in compressor design and behaviour and allows the designer to choose a single spool with a very high pressure ratio without making its operation critical at "off-design" points—since correct blade angles are maintained over all kinds of operation.

In the J79 the first six stator rows are variable out of 17 stages on the whole compressor. The photograph shows the geometry of part of the actuating mechanism. Engine oil feeds a jack which, by means of a suitable assortment of linkages, positions rings surrounding the compressor casing and bearing radial arms on the pivot axis of each stator blade. Single-lever control governs an automatic control system which selects fuel flow and r.p.m. and adjusts the stator operating ram to keep the compressor on its optimum operating line.

Among the many advanced features of the J79 are several worthy of discussion here. A most important advantage of the single-spool layout, made possible by the variable stators, is that the main rotating assembly has but three bearings: a roller bearing at the front (this bearing is of exceptionally small diameter owing to the very low hub/tip ratio), a ball thrust-bearing at the rear of the compressor and a roller bearing immediately behind the three-stage turbine. In the military J79 a high proportion of light alloy is used at the front end, which is anticed by bleed air passed through the intake struts and inlet guide vanes. Inspection times are reduced, say G.E., by adopting horizontally split casings over the compressor, combustion chamber and turbine section. Most J79s are at present on a 50-hr basis.



Pride of General Electric: the CJ-805, the commercial transport version of the J79 turbojet. The six variable stators can be discerned.

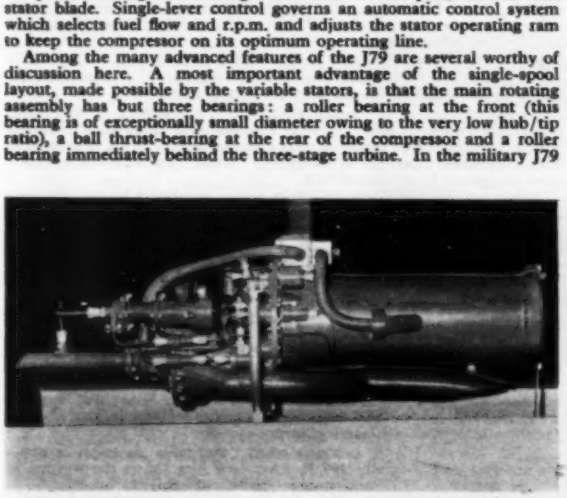
Accessory power is taken from the front of the engine, down an intake strut to the forward gearbox, from which a horizontal shaft transmits the drive to a second box (chosen "to reduce trouble areas") under the intermediate transverse joint which separates the casing over the six variable l-p. stages from the 11 h-p. stages. Provision is made for all engine accessories to be driven by one or other box, and airframe units such as generators and hydraulic pumps can also be installed. The basic J79 design also makes provision for substantial tapping of compressor-delivery air.

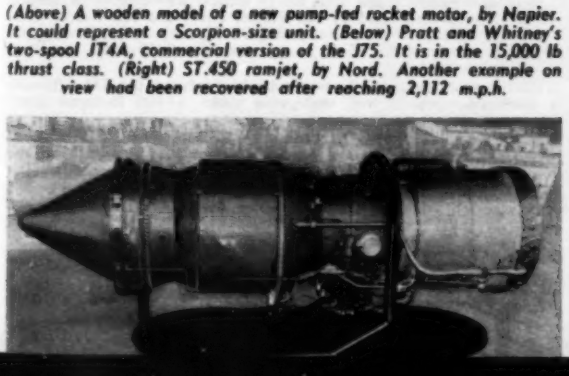
The military J79 was in detail design in January 1953. It first flew in a Douglas XF4D in December 1955, and has since flown in B-45, F-104A, F11F-1F and B-58, the latter three machines being specially designed to use the engine. The B-58 has a very advanced J79 nacelle with fully variable intake and reheat propelling nozzle. Most of the J79s so far delivered have reheat (i.e., afterburning). The maximum sea-level static rating with reheat is about 16,000 lb, and the engine is well adapted to flight at over Mach 2 (a speed which it has many times exceeded in the F-104A). Without afterburner the high pressure-ratio gives excellent economy for subsonic cruising. The design is of such quality that the overall envelope of the engine is smaller than that of the company's earlier J47; comparison of figures is revealing: J79 intake scantling diameter, 32in (J47, 36½in); weight with afterburner, under 3,200 lb (J47, 3,250 lb): reheat thrust, 16,000 lb (J47, 7,650 lb).

From the J79 has been evolved the CJ-805 commercial jet engine, intended for airline applications. To meet the need for extreme life the all-steel compressor design has been extended to include a steel casing over the variable stages. Design of the 805 began at the end of 1955 and commercial deliveries—initially for the CV-880 transport—are scheduled to begin in mid-1958.

Also exhibited by G.E. was the equally advanced T58 free-turbine engine which has been developed to meet a U.S. Navy requirement for a lightweight unit in the 1,000-s.h.p. class. Currently rated at 1,024 s.h.p., for a total weight of 325 lb (250 lb without gearbox), two T58 units are currently powering an S-58 helicopter and two more will soon fly in a Vertol H-21. Over 3,500 bench hours have been run and all requirements, including 150-hr testing, have been exceeded. Breguet announced at the Salon the intention of using the T58 in the Integral (p. 738), and S.N.E.C.M.A. may use the engine in a future coleopter.

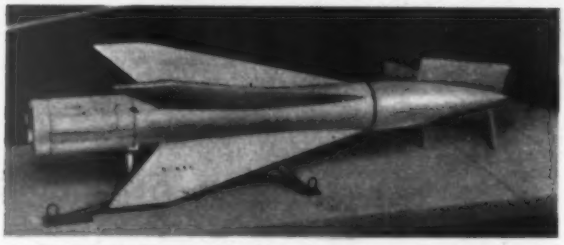
Hispano-Suiza. Although this famous firm have done a superb job in developing and mass-producing centrifugal turbojets of basic Rolls-Royce design they are currently receiving very little government support for future engines. At present without such support is the trim R.804 axial





(Above) A wooden model of a new pump-fed rocket motor, by Napier. It could represent a Scorpion-size unit. (Below) Pratt and Whitney's two-spool JT4A, commercial version of the J75. It is in the 15,000 lb thrust class. (Right) ST.450 ramjet, by Nord. Another example on view had been recovered after reaching 2,112 m.p.h.

Another new engine, the Bastan turboprop. It is one of three completely new units which are starting a Turboméca family.



The neat, but only just sonic, air-to-air missile by Nord. Designated Type 5103, this example was the 640th production round made.

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(rated at 3,307 lb thrust without reheat), although it has passed all its tests up to the 150-hr qualification. Hispano were also unable to proceed with licence-production of 200-series Avons.

Some 1,300 Nenes had been delivered when production ceased, and over 500 of the larger Verdons. One of the latter is displayed, with a 7,700 lb rating.

Motoimport. Sales organization for Polish engines, this Warsaw group are chiefly concerned with Wiktor Narkiewicz's WN-3 radial. A neat seven-cylinder unit, mounted in the Bies trainer in a close-fitting cowling with intake cooling shutters, the WN-3 gives 335 h.p. and weighs 530 lb.

Napier. Almost the only new British exhibit is a full-scale wooden model of a pump-fed kerosine/H.T.P. aircraft rocket motor (illustrated on page 741. No details can be given but it seems fair to accept the design as being related to the Scorpion. Two Scorpion barrels can be seen under the belly of a Canberra model, also on view.

In addition, the company display their entire range of powerplants—Elands, Gazelle, Oryx, ramjets and rocket motors for missiles—and announce larger sizes of H.T.P. tip-drive boost rockets for helicopters in the S-55 class. A new designation is Eland 229, for the Westminster helicopter.

Nord. The French S.N.C.A. du Nord now embrace the former S.F.E.C.M.A.S. (Arsenal) organization, whose ramjet work has now resulted in the impressive ST.450 test vehicle (illustrated on page 741). Boosted by twin cordite motors carried on a frame with swept fins, the main vehicle contains an integral ramjet of 17.72in diameter. The forebody, containing all the expensive moving parts and equipment, is recoverable by parachute; and one such unit—still bearing signs of aerodynamic heating from a trip to 75,500ft at over 2,100 m.p.h.—is exhibited, standing on its nose spike.

Nord also make complete afterburning jet-pipes, with variable nozzle, for the Turboméca Gabizo.

Omnipol. This is the sales organization for Czech engines and displays the new M.332, a direct-injection four-in-line rated at 140 h.p. and weighing 230 lb. It will power later Metasokols. Also on view are Walter Minor 4-IIIs and the Praga Doris B (first shown at Paris 1955).

Orenda. The cut-away display exhibit of the later-series Orenda (two-stage turbine) is one of the finest in the world. Of the Iroquois not even a mock-up can be displayed.

Piaggio. This Italian company show one of their licence-built Lycoming GO-480 flat-sixes.

Potez. Current four-, six- and eight-cylinder units are on view, together with a neat 1,500/2,200W motor generator.

Pratt and Whitney. The big J75, shown as the JT4A commercial engine in "the 15,000 lb-thrust class" is less bulky than one might expect, and represents considerable advances over the earlier J57s. The exhibit is authentic and carries two G.L.A. high-voltage igniter boxes, Holley fuel control and a saddle oil tank holding no less than 9 U.S. gal.

Alongside is a rotating, sectioned JT3, or commercial J57 (the first sectioned two-spool unit ever to be displayed). Even the Hydro-Aire pneumatic gate valve and water-injection control is sectioned—but, due to a quirk of Pentagon rules, Pratt and Whitney cannot distribute literature revealing its interior. We ourselves attempted to count the blades on the compressor, and found 25, 27, 37 and 51 on the first four stages: at this point we felt there must be better things to do in Paris.

Rolls-Royce. Dart noises from the air terminal constantly permeate the entire Salon, showing that Rolls gas turbines really work for their living. By the display RDa.7 engine is a notice giving the latest round-figure total of Dart airline hours as over 2,500,000. Likewise a placard alongside the RA.26 Avon states that Avons have flown over a million hours. The RA.29 s.f.c. is revealed as 0.775.

The biggest revelation, however, was the static thrust ratings of the final civil and military Conways. Fully expecting clearance, the company prepared a placard bearing the figures, and it was inadvertently left on show for a brief period. We prefer to withhold them from publication until they appear elsewhere.

Salmson. An industrial version of the new 4AH, 100 h.p. unit is displayed. A special helicopter variant of this family is at present on certification testing. Fuel-injection (Bronzavia and Zenith versions) has now been fitted to the 260 h.p. 8AS-04.

S.E.P.R. The premier Continental rocket firm exhibit a tremendous variety of motors, including a complete power pack in the 661 family (Trident and Mirage motor). Like previous S.E.P.R. units it is a nitric acid/furfuryl alcohol motor, with turbopump feed to aluminium chambers regeneratively cooled by the acid. No thrust variation is provided, but chambers can be fired or shut down individually. Chambers can be of 1,653 or 3,307 lb rating.

Several big solid-boost units for missiles or test vehicles range up to 44,530 lb thrust, and a particularly interesting display is devoted to the firm's Omnifor nitric-acid inhibitor, an additive (to the acid) which completely eliminates corrosion on metal parts.

S.N.E.C.M.A. A very fine Atar 9 (13,228 lb with afterburner) is on view, this being a real engine similar to those for the B.4 Super Mystère and Mirage III. The slightly earlier Atar 8, the first of the Atars with a raised pressure ratio, is flying in the Etendard IV. A cut-away Atar E is on show, these units having run bench tests of a thousand hours and actually being overhauled on a 500-hr basis in the Vautour.

Other exhibits concern large ramjets, reverse thrust, coleopters, the Flying Atar and the licence-built Hercules (over 1,000 delivered).

Turboméca. This famous small-turbine firm have embarked on a wholly new family of engines, embodying new techniques and with advanced design points. The first to appear—they are not yet on the bench—are the Bastan (illustrated on this page), of 750 h.p. and weighing 397 lb without its propeller, and the Astazou, a 320 h.p. unit. The Tramontane, an air-compressor of Marboré size with a delivery of 5.5 lb/sec, is on view, as are new variants of the Artouste and Turmo.

MISSILES AND TARGETS

UNLIKE ourselves, France has paid great attention to guided weapons with elementary "first-generation" characteristics. Certain of her earliest missiles, dating from around 1953, are in evidence at the Salon.

Bristol. The whole centre of the Salon is dominated by a Bobbin test vehicle for twin 16in Thor ramjets. The exhibit is a genuine Bobbin which has actually been fired and recovered (and repainted). News of the definitive Bloodhound weapon is published on page 722 of this issue.

Curtiss-Wright. C-W's subsidiary, Aerophysics Development Corporation, exhibit one of the HTV (hypersonic test vehicle) rounds which they have mass-produced for some years for the U.S. Air Force and other agencies.

D.E.F.A. Signifying *défense contre avions*, this office of the French National Defence Department exhibits a PARCA anti-aircraft weapon. Although able to reach 82,000ft altitude PARCA flies at only Mach 1.7 and has been superseded by later surface-to-air weapon systems.

E.C.A. The E.C.A. 56 is a neat winged target towed behind Canberras and Vautours at over Mach 0.8. Its glass-resin honeycomb fuselage is very narrow and is in every way (even to colour) reminiscent of a goldfish; projected side area is 54 sq ft. Lateral stabilization is by gyro and spoilers, and a brake-chute canister, hit counter and corner-type radar reflector are provided. E.C.A. 56 is in production and may later appear with its own powerplant.

E.C.A. 57 is a small glider target, with a concrete-filled wing. It is designed to fly a 7-deg glide at 430 m.p.h. and carries a radar reflector and a smoke generator in its circular-section body.

English Electric. A tunnel model of Thunderbird is exhibited, mounted on an early army launcher running on a railed track provided with a turntable. The model depicts a system which seems now to have been superseded in favour of completely mobile launchers which do not have to operate from a fixed base.

Fairey. As agents for the Jindivik target developed by the Government Aircraft Factories in Australia, Fairey exhibit a very fine specimen of one of these outstanding little aircraft. Powered by a Viper turbojet, the Jindivik 2 has a Perspex fore-decking through which can be glimpsed the Elliott Brothers autopilot.

Fireflash, the Fairey beam-riding air-to-air weapon, is much in evidence on the company's stand.

Martin. A tactical missile squadron of the U.S. Air Force drove up from Sembach with one of their TM-61C Matador weapons. Complete with boost motor, launcher and support gear, it makes an impressive display.

Matra. Examples of the Type 510 (M.20 or AA.20) air-to-air missile are displayed in the Salon and beneath a Durandal. Some 10ft long and weighing 450 lb, the 510 has a Matra autopilot and is guided by a Drivomatic optical command guidance system.

Nord. Type 5103 is a widely used beam-rider air-to-air weapon, 8ft 6in long and weighing 297 lb. A colour film shows the weapon in action, with both H.E. and smoke (spotting-charge) warheads.

Nord also exhibited the little SS-10 tactical wire-controlled missile, which is not widely used by the French Army and Air Force. It is being supplemented by the swept-wing SS-11, with an improved speed and range. Price of the SS-11 is approximately £450-£550, the latter including warhead.

Northrop. Biggest missile ever publicly displayed, the SM-62 Snark is exhibited complete with underwing tanks, 33,000 lb-thrust boost motors and launching trailer.

O.N.E.R.A. The Type 320 S two-stage launching vehicle is displayed together with an aerodynamic test model (Type 2021 P) freed from the boost system at 33,000ft at about Mach 2.5.

Republic. The Republic-manufactured ASP high-altitude, hypersonic research vehicle is exhibited.

IRISH BIRTHDAY

"Twenty-one Years a-growing": Aer Lingus Celebrate 21st Anniversary

An early Aer Lingus poster (summer, 1936), showing a D.H. Dragon in the livery of Blackpool and West Coast Air Services, in conjunction with whom Aer Lingus operated certain routes.

IN Ireland, economic considerations and political events have encouraged the State to intervene actively in some branches of commerce. The state-sponsored air companies, Aer Rianta and Aer Lingus, are examples of the intermarriage of Government development of civil aviation and sound commercial policy. The success of this system is shown by Aer Lingus, which since 1936 has grown from a single-route airline operating one aeroplane into an important network, with an international reputation for reliability and efficiency, operating five Vickers Viscounts and 13 Douglas DC-3s.

During its twenty-one years of operations, Aer Lingus has transported over three million passengers and lifted over 55,000 tons of freight and mail, 90 per cent of which have been carried over the last ten years. The Aer Lingus system is of an extremely short-haul nature and the company has more than its fair share of the problems usually confronting this type of operator. It would, indeed, be difficult to find a scheduled airline anywhere which has such an immense "peak and valley" demand for service. In order to avoid the three valleys—night, mid-week, and winter—incentive fares have been introduced on some routes and have succeeded in some degree in reducing the unbalance.

In 1936, Aer Lingus started operations in a modest way by providing a daily return service between Dublin and Bristol, using a D.H.84 Dragon seating five passengers. At that time the entire staff of the company numbered 12 people, and all the spares were contained in a large biscuit-tin! Today, the aircraft fleet is 18 times as great, and the Aer Lingus and Aer Rianta staffs comprise 2,000—including seven of the original dozen. By international standards, Aer Lingus is still a small airline, but it has built up a fine reputation for efficiency, regularity and safety of operations, as reflected by the fact that in 1950 it was awarded the Cumberbatch Trophy by the Guild of Air Pilots and Air Navigators of the British Empire. The smallness of the company is in itself an advantage, for there is an unusually friendly approach and personal touch to its relations with the travelling public—factors which appear all too rarely in many of the larger organizations.

Aer Lingus is a subsidiary of Aer Rianta, which was established to maintain external and internal air services, to develop air navigation and to foster aeronautics in Ireland. Aer Rianta is not itself an operating organization, though for the last 17 years it has managed Dublin Airport on behalf of the Minister of Industry and Commerce.

The revised Anglo-Irish Air Agreement of 1936 provides for an Aer Rianta holding in Aer Lingus of 90 per cent, with British European Airways holding the remaining 10 per cent. Between 1946 and 1956 Aer Lingus had a monopoly of all services between the Republic of Ireland and the United Kingdom, but now B.E.A. or British independent operators share some Ireland/U.K. routes with Aer Lingus, whilst other routes are exclusively operated by Aer Lingus or by independent operators. Aer Lingus now have fifth-freedom rights at Manchester on routes to Amsterdam/Düsseldorf, Brussels/Frankfurt and Zürich/Rome.

Operational History. In addition to the original daily return service between Dublin and Bristol, inaugurated on May 27, 1936, seasonal routes were operated to the Isle of Man and Liverpool, in conjunction with Blackpool and West Coast Services, and the Dublin/Bristol service was extended to London later in the same year. All services were suspended on the outbreak of war in September 1939.

In October of that year the Liverpool route was re-opened, and this service operated right through the war years. Manchester was used as the terminus between August 1940 and November 1942. In spite of wartime difficulties, a total of over 41,000 passengers were carried between 1939 and 1945, and January 1940 saw the opening of the new Dublin Airport at Collinstown, about 5½ miles north of the city.

Like most airline operators all over the world, Aer Lingus expanded rapidly at the end of hostilities, but it was some little time before the route pattern was finalized and suitable equipment chosen. In the year 1945-46, over 21,000 passengers travelled on the services to London, Paris, Shannon and Liverpool. For the next twelve months the company concentrated on these four routes, replacing the de Havilland aircraft with DC-3s.

In 1947, no fewer than eight new routes were opened—from Dublin to Amsterdam, Belfast, Glasgow, Brussels and Manchester; from Shannon to London and Paris; and from Belfast to Liverpool, using Viking V.634s. Constellation L.749s (on hire from Aerlinte, the projected transatlantic company) were introduced on the Dublin-London service and on a new Dublin-Rome service.

(Upper) The first Aer Lingus aircraft, D.H. 84 Dragon "Iolar" (Eagle), purchased in May 1936. (Lower) Bought in the summer of 1936, D.H. 86A Express "Eire" flew on Aer Lingus routes for over ten years.

EI-ADD, L.749 Constellation "St. Kevin" of Aerlinte Eireann (Irish Airlines), was used by Aer Lingus on the Dublin-London and Shannon-Rome routes in 1947-48, pending its purchase by B.O.A.C.

IRISH BIRTHDAY . . .

The first Aer Lingus DC-3, EI-ACA, was bought from the Fokker company in April 1940, a few weeks before Holland was invaded by the Germans. It was destroyed by fire at Shannon Airport in June 1946.

By June 1948 the Constellations and Vikings were withdrawn from use and the services Dublin-Belfast, Dublin-Rome, Dublin-Brussels and Belfast-Liverpool were suspended. In the ensuing twelve months a further increase in traffic justified the re-opening of the seasonal Dublin-Isle of Man service and the addition of another seasonal route to Jersey. The Shannon-London service was delivered *via* Dublin and an all-the-year-round service between Dublin and Birmingham was introduced. The first "Starflights," air-coach night flights, were introduced on the Dublin-London route in 1950 to offset the night "valley."

Since 1951, a DC-3 has left Dublin Airport each weekday night for Manchester carrying all first-class mail between the Irish Republic and the United Kingdom. This "all-weather" flight returns to Dublin shortly before midnight, carrying U.K. mail for Ireland. By August 1951 the company had carried its millionth passenger and re-opened the original Aer Lingus route to Bristol. In 1951 Aer Lingus ordered four Vickers Viscount V.707s, to be delivered in the spring of 1954—the first company, after British European Airways, to order these aeroplanes. Pending the arrival of the V.707s, four Bristol B.170 Wayfarers were ordered, for delivery in 1952, to cater for increased passenger and freight traffic. Two further routes, to Edinburgh and to Cardiff, were opened in 1952, and "Starflights" to Manchester were also introduced.

The arrival of the Viscounts in the spring of 1954 considerably altered the pattern of the company's operations, and enabled new routes to be opened in 1954 and 1955 to Lourdes and to Biarritz and Barcelona. In the following year, 1956, the company placed orders for new equipment in the form of three 65-seater Viscount V.808s and five Fokker F.27 Friendships, a logical partnership of short-haul turboprop aircraft.

Equipment. The Dragon with which Aer Lingus began operations in 1936 was joined later in the same year by a D.H. 86A, the airline's first four-engined aircraft. The Dragon was replaced in 1938 by a D.H. 89 Dragon Rapide and a D.H. 86B Express was also purchased in the same year. The first American aircraft, two Lockheed L.14s, were delivered just before the war, and they were followed in 1940 by the first Douglas DC-3. The latter aeroplane is interesting for two reasons; first of all, it marks the beginning of Aer Lingus Dakota operations over 17 years, and, secondly, this aeroplane was bought from the Fokker company in April 1940, shortly before Holland was invaded. (Now Aer Lingus has once again bought aeroplanes from Fokker, for the five Friendships, already mentioned, are due to be delivered in late 1958.) During the war years the two D.H. 86s and the DC-3 carried all the traffic until joined by a Lockheed L.414 Hudson and, for some obscure reason, a Supermarine Walrus. At the end of hostilities, a fleet of nine DC-3s was introduced into service to replace all other types. When, in 1947, five L.749 Constellations were delivered to Aerlinte Eireann, the Irish overseas airline, to operate transatlantic services (subsequently suspended and later cancelled by Governmental direction) these aircraft were hired by Aer Lingus for a time and eventually were sold to B.O.A.C. in 1948.

For about twelve months, between 1947 and 1948, a fleet of seven Viking V.634s was added to the existing fleet of DC-3s and

(Centre) EI-ADF "St. Ronan" was one of seven Vikings used by Aer Lingus in 1947-48; it was later sold to Misrair. Collinstown's tower had not at that time been fitted with its "bandstand." (Left) Bristol Wayfarer EI-AFP was originally G-AINL, owned by Bristol Aeroplane Co.; it was used in the summer of 1952 in company with -AFQ, R, S and T, purchased by Aer Lingus pending delivery of their first Viscounts in the spring of 1954.

EI-AFV, Viscount V.707 "Padraig," is the flagship of the Aer Lingus fleet. This photograph, taken very recently, shows the current Aer Lingus Viscount livery, which will also be worn by the new V.808s; the first of them is illustrated below.

these were disposed of to Misrair (Egyptian Airlines) and to Airwork, Ltd. In addition to the four Wayfarers mentioned earlier, two Airspeed AS65 Consuls and two Miles M.65 Geminis were operated at various times by Aer Lingus on behalf of Aer Rianta.

The success of the four Viscount V.707s introduced by Aer Lingus in 1954 led to the order of three of the larger V.808s, seating 65 passengers. One will enter service this summer and will be used on the busy Dublin-London route alongside the B.E.A. V.802s. Delivery of the remaining two 808s which will also be used on the Dublin-London route will be made towards the end of this year. With the delivery of five F.27 Friendships in 1958, Aer Lingus may be among the first airlines in the world to operate an exclusively turboprop passenger fleet.

Staff. Aer Lingus staff are mainly recruited locally, providing a very useful outlet for the growing technical ability of the younger generation. Aircrews are mostly Irish nationals who have served in the Royal Air Force, Fleet Air Arm and Aerchór (Irish Air Corps), whilst ground-crews are most ex-Aerchór. In addition to training air- and ground-crews of other airlines in Viscount operations, Aer Lingus has provided the managers in Ireland for several well-known European airlines. In common with most operators, Aer Lingus has a high wastage-rate through marriage of its female staff—the average duration of employment of female staff is 3½ years. In the hostess branch, the rate is extremely high, the average "survival" being a little under two years.

This spring, to mark the 21st anniversary of Aer Lingus, the familiar green-gabardine-garbed girls of Aer Lingus have appeared in a new "Donegal green" tweed uniform, designed by Miss Irene Gilbert, the well-known Irish couturière, which replaces the uniform worn since 1947. The "Kerry" tam o' shanter is a completely new departure in airline headgear, upswept in an appropriate wing shape, with a Celtic design cap-badge.

Economics. During the financial year 1955-56, Aer Lingus earned a total revenue of £2,612,623. Expenditure amounted to £2,429,478, leaving an operating surplus of £183,145 and a net surplus, after deductions, of £41,495. Passenger revenue amounted to £2,103,164, and excess baggage brought in £23,689. Cargo revenue amounted to £210,434

During the half-year to September 30, 1956, the company carried 314,056 passengers, 3,082 tons of cargo and 837 tons of mail, and flew 17,370 revenue hours. Utilization for four Viscounts and 13 DC-3s was 2,037 hours per aircraft; the passenger load-factor was 76 per cent; and the all-cargo load-factor 65 per cent. Total revenue for the period was £1,892,400 (half-year to September 30, 1955, £1,683,900); total expenditure was £1,548,400 (£1,370,900), giving a surplus of £344,000 (£313,000).

Aer Lingus is now about to embark on its twenty-second year faced with competition on routes on which it has hitherto exercised a monopoly. B.E.A. will operate on the London-Dublin, Manchester-Dublin and Birmingham-Dublin routes alongside Aer Lingus. In addition, new routes to the Continent, including Dublin-Manchester-Brussels-Frankfurt and Dublin-Manchester-Zürich-Rome, as well as an extension of the Amsterdam route to

EI-ACE, Douglas DC-3 "Colmcille," second oldest unit of the Aer Lingus fleet, seen at Collinstown in its present-day livery.

Düsseldorf, have been put into operation. This important change in the operating pattern marks a critical point in the history of the company, making as it does a complete transition from the rôle played by Aer Lingus over the last 21 years as an ultra-short-haul local operator. It may well be some little time before the results of the new policy are seen; in the meantime, every individual in Aer Lingus is on his mettle—and the Irish are very proud of their national airline. L. S.

This photograph of the first of the three Viscount 808s ordered by Aer Lingus brings the story up to date: taken at Vickers' Wisley airfield on Wednesday of last week, it shows EI-AJI shortly before its collection by an Aer Lingus crew.

Sideslipping past the photographic aircraft, the Jet Provost reveals a not unhandsome topside aspect. Ejector seats and a frameless windscreen will be incorporated in production Mk 3s for the R.A.F.

JET PROVOST in the Air

NO. 56 OF THE SERIES

ALL-THROUGH jet training is now to become standard practice for R.A.F. pilots as a result of the Service trials which have been carried out at No. 2 F.T.S., Hullavington, Wilts (*Flight*, March 8). Though comparable trials have to date been held by several air forces, the method has only now been adopted, because the particular aircraft used were not exactly suited to the task. The warm enthusiasm of the R.A.F. for the new procedure has been to some extent due to the qualities of the Jet Provost; and *Flight* welcomed the opportunity, recently offered by Hunting Percival, of sampling the machine personally.

As an experienced R.A.F. instructor during World War 2 the Editor flew the Jet Provost—a Mk 2 prototype—and he here compares it with the aircraft in which he worked some years ago. On page 748, C. M. Lambert records his impressions as a pilot much of whose flying experience has been in modern jet aircraft—particularly Meteors. Both writers liked the Jet Provost well and felt it would fill its R.A.F. rôle admirably.

Among the advantages noted during the Service trials was the combination of basic-trainer performance with true jet handling characteristics. Yet the Jet Provost is not only a good teacher of jet characteristics, but also a very fine teacher of pure flying. The one follows naturally from the other; and the R.A.F. is finding it can train better pilots in fewer hours.

TWENTY YEARS ON

By THE EDITOR

IF you could lift a World War 2 pilot out of his office chair and drop him into the cockpit of a jet fighter—straight and level at 20,000ft—he would probably tell you that flying was still a piece of cake. And within limits it still is. The simple motions of flying, like the old jargon, come back to you over ten or more years; yet the extent and degree could scarcely be more different.

The parallel is as true of trainers as of fighters. It is a far cry from Tiger Moth to Jet Provost, yet both do the same "elementary" job. On experience to date, it is being said that instructors have under-estimated the abilities of *ab initio* pupils: in spite of the inevitable elaboration of a modern basic trainer such as the Jet Provost, the new boys are getting off solo in about the same time as in the past. The big difference is now seen in the end product—a trained pilot of high standard versed in all the latest procedures and fully prepared for the next step to, perhaps, a Hunter at 230 hours.

Early results have fully confirmed the protagonists of all-through jet training (with conversion back to propellers if necessary, later on). If a pilot can think in terms of jet work from his very first flight, he is all the better and earlier prepared for his operational career in a modern air force.

Later in this account, the flying characteristics of the Jet Provost will be assessed with particular reference to the aircraft which will follow it for an R.A.F. pilot; but for the moment, let us see how it compares with the piston-engined trainers of a generation 20 years ago.

Speed, climb and other figures give a quick indication of performance advances. The Tiger Moth was (is) good for, say, 105 m.p.h. in level flight low down; the Jet Provost achieves 350 m.p.h. at 30,000ft and 325 m.p.h. at ground level. The Tiger's rate of climb from the deck is 670ft/min; that of the Provost 2,880ft/min. The Provost carries 164 gallons of kerosine for just under two hours' flight or 340 miles' range; the Tiger 19 gallons of petrol for a longer endurance and slightly shorter range.

Almost everyone who flies, or has flown, in England knows the Tiger cockpit; and rather than compare its simple contents with those of the side-by-side Provost layout, it is best to describe—in conjunction with the illustration—what is found necessary today. The Provost cockpit, the outcome of trials and conferences with our own and other air forces, is outstandingly good in its arrangement and equipment. It could not be described as roomy, but neither is it cramped. The many additional items which make it relatively complicated are concerned with electrics, radio, air brakes, flaps, trimmers and a more elaborate fuel system. All these are logically grouped and familiarity with the layout is a question of study before take-off. The basic controls and blind-flying instrument panel—the things that really matter to a pilot—are just as always.

Wherever desirable and possible the controls are sequenced, in the sense that the next one to be required lies immediately ahead of, or behind, the one in use. For example, with one's hand on the power lever in the fully open position, the forefinger can reach to press the wheels-up selector switch.

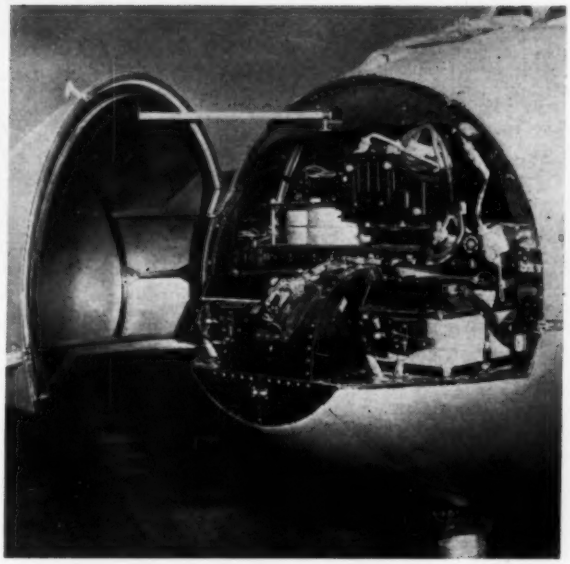
There are also, of course, safety devices wherever they are desirable. Naturally, the power lever cannot be moved beyond the taxying position if the controls are locked. There are other simple safety precautions born of experience through the years. For example, the elevator trimmer wheel has a large notch in its rim, and the total movement is only 180 deg in each direction from neutral; thus there can be no fear of confusing the setting before take-off.

Microswitches prevent the undercarriage being raised while the weight of the aircraft is still on it, but we do not find Percival pilots over-eager to demonstrate this feature (nor have we the pilots of any other machine so equipped!).

Returning to the Tiger-with-Provost comparison, and assuming the external pre-flight inspection to have been carried out, how do we start up? There is, of course, a marked refinement about the procedure today. "All clear outside" means not around the propeller in the nose but the wake of the jet at the rear. Switches—battery isolator, ignition isolator, starter motor—go on first (the parking brake is already set); the low- and high-pressure cocks are opened; and then the button is pressed to energize the automatic starting cycle of the Armstrong Siddeley Viper ASV.8.

It is usual to taxi with controls locked; the positioning of the stick according to wind direction relative to the aircraft is a thing of the past. Heading is controlled by the toe brakes on the rudder pedals and it needs a hard push to start or stop a turn. Equally hard is the effort to resist the urge to move the rudder to assist turning on the ground. This would have no useful effect and would merely make operation of the brakes more difficult.

Take-off could not be easier. Any pilot, however inexperienced, should be able to get the Provost airborne if it were prepared and lined up for him. The power lever, still officially called the throttle, is opened fully against the brakes and then, on release, the aircraft accelerates quite slowly on its 350-yd run without change of



Radios, electrical equipment and batteries lie readily accessible behind the hinged nose-cone.

direction or attitude. The rudder starts to have effect at 40 to 45 kt and at 70 kt the nose can be raised by easing the stick back a little. Then, almost at once, the Provost flies off and it would be easy to bonk the tail on the ground if the stick were pulled back too hard. So far this is familiar stuff. Raising the wheels and flaps when beginning to climb at, say, 90 kt causes a slight trim-change (the one nose-up, the other nose-down) and there is a slight sink as the flaps come in. The whole procedure is simple and unhurried.

As speed builds up from 90 kt to the correct climbing speed of 160 kt to 10,000ft, control sensitivity increases and changes of flap or wheel position would all produce a more pronounced trim-change. The rudder feels much as it has always done in trainers and the ailerons are startlingly light and effective, particularly in their initial inch of stick movement. Elevator control is also on the sensitive side and three or four g can be pulled very easily indeed—to the discomfort of anybody accustomed to flying only light aircraft. The elevator trimmer is very powerful.

Batting around the sky at 200 to 220 m.p.h. may be approach stuff to a P.1 pilot, but for a basic instructor it is still hurrying. Yet the aircraft is very smooth indeed, the noise level is low, the view good, and comfort in terms of heat, fresh air and oxygen very tolerable. The seat is still one's parachute—with bale-out oxygen bottle added in a position which gives an occasional warning tap on the coccyx. In the last fifteen years radio reception has improved a lot in theory but little in practice. If you could stop the interference and choke off all the long-winded professionals using the air, it would no doubt be near perfect. Certainly Coltishall seemed to come through more clearly to a Mosquito pilot over the Dutch coast in 1944 than Luton to a Provost over Letchworth. But maybe our old ears deceive us.

What of aerobatics? A loop used to be easy and a slow roll more difficult. Give the Provost a touch of aileron in either direction at cruising speed and it rolls as precisely as a specimen bug on a pin. A loop, on the other hand, needs rather more finesse. Speed should be around 220 kt and the pull-up calls for about 3g. Rudder and aileron may be needed to keep straight. There is no real difficulty, but it has to be done right. The same remark applies to a roll off the top.

About the most important characteristic of a trainer is a sweet stall. It should be straight, smooth and heralded. On the Provost that is just about how it is—although the warning buffet is very small. It is much the same with power on and off and when clean or dirty. No embryo pilot should run into trouble, nor is he likely to spin off a stall. To give warning of dangerously low speed on the approach there would be ample indication in control feel, sink and, last of all, buffet. If the very effective air brakes are used at low speed they might mask the slight stall warning. In general terms, the stall is just as safe and docile as with biplane trainers of the recent past.

Safe endurance for training flights with normal tankage at the lower levels is not much over one hour, and 33 gallons are usually allowed for circuit and reserves. Once familiar with the landing procedure, a pupil in a Jet Provost has an easier task than if he were in a Tiger. Less judgment is needed at all stages. Wheels are dropped downwind, and at the speed of 120 m.p.h. trim-change is only slight. Flaps to take-off gate follow, again with little trim-change. It remains to aim at the runway at about 100 kt, lowering to 80-85 kt over the boundary. The air brakes and flaps are there to increase descent without cutting the Viper to less than 8,000 r.p.m. (minimum, from which it will accelerate to full thrust rapidly).

The aircraft thus arrives at the round-out position in almost its landing attitude. If the power is gently cut back it sinks on to its wheels and can be allowed to rock forward on to its nosewheel at once. The instinct to hold off has to be resisted, otherwise you may arrive tail-first. A pupil who starts on jets (or nosewheel types) is not bothered by thoughts of traditional three-point attitudes.

Just as the take-off run is long because small jets do not bite like propellers, so the landing run is long and trundling because the aircraft is so clean. There does not seem to be any tendency to diverge from the straight line; but if there were the brakes would be ready to make a correction.

The real differences in today's basic jet trainers lie in the airspeed and the rate of doing, and in the need to be familiar with all the extraneous equipment and devices, including those for high-altitude flying, safety and emergencies. The difference in fuel consumption at economical cruising and full thrust, even with the little Viper turbojet, has also to be seen to be credited. Circuits and the basic flying manœuvres are easier to learn in the Jet Provost than in any previous R.A.F. trainer.

OVERLEAF: A Meteor pilot's reactions to the Jet Provost.

The Jet Provost cockpit, showing the instructor's central power-lever pedestal, which also carries air-conditioning and fuel levers, radio controls and aileron trim wheel. There is a single central blind-flying panel and all engine and fuel instruments are concentrated to the left, in front of the pupil. Occasionally used switches and circuit-breakers are on the starboard console. Oxygen and engine-starting controls are all arranged immediately to the left of the central pedestal.

The short undercarriage legs of the Jet Provost Mk 2 can absorb very high touch-down rates of descent. By contrast with earlier trainers, the rudder is not normally used for taxying.

JET PROVOST
in the Air . . .

A METEOR PILOT'S REACTIONS

By C. M. LAMBERT

NOW that I have sampled the Jet Provost I can well understand how the R.A.F. flying training authorities arrived at their very high opinion of the machine as a basic trainer. I have flown a number of light jet aircraft from the Vampire Trainer down to the Sipa 200 Minijet; but in none of them did I find exactly the Jet Provost combination of real jet-aircraft handling characteristics with true simplicity and moderate performance. The main purpose of a turbojet basic trainer is, after all, to teach a pupil from the outset the essentials of jet aircraft handling while not exposing him from the very first to the blistering performance he will later meet in his operational type.

The Jet Provost provides exactly this quality; the take-off run is long enough in time (though not necessarily in distance) to reproduce quite faithfully the take-off of some much heavier machine like a Meteor. There is nothing of the tail-lifting and swing-correcting interlude between "brakes off" and fully airborne which is so characteristic of small piston-engined aircraft. The undercarriage is operated by push-buttons; retraction and extension are very fast and virtually free from trim changes or thumping and rumbling noises. Flap selection is by a small lever which has a single gated intermediate position to give take-off setting, and needs neither fumbling nor watching. In fact, the quicker the lever is moved the better.

The power-lever action is very good; there is just enough friction to keep the lever where it is put, so that it can be moved easily with a touch of the hand; and the range of movement does not at any time exceed comfortable arm displacement. An acceleration control on the ASV.8 Viper allows the pilot literally to slam the power lever open from the 8,000 r.p.m. position, and the acceleration of the engine itself is quick and smooth. Raising of take-off flap causes a very small, firm trim-change combined with an almost imperceptible sink. A rate of climb of some 2,000ft/min can be maintained steadily to something over 10,000ft, starting the climb at about 170 kt and decreasing speed by 1.5 kt each thousand feet.

Visibility, even through the heavily framed piston-Provost canopy at present fitted, is good in all directions, though there is some interference on the left from the heavy windscreen bridge structure. In service, Jet Provost Mk 3s will, of course, have the fully transparent windscreen and a slightly re-worked canopy.

After I had taken off I climbed to 7,000ft, levelled off, and retained climbing power in order to observe the acceleration. It was slow but steady, and a gentle progressive nose-up trim-change accompanied the build-up of speed. When I reached 220 kt I applied elevator trim and found it extremely sensitive. As the Editor has remarked, the whole trim-range is encompassed with about one revolution of the trim wheel, a large cut-out in the rim making the datum position instantly appreciable to both hand and eye. The elevators give a firm, smooth response, the forces increasing steadily as speed builds up and being very well matched with the Provost's response. A sensible pull produces 2g and twice that figure requires a pull which is firm but not too heavy.

The ailerons are light and extremely effective at all speeds, giving an excellent approximation of the characteristics of fully powered ailerons with spring feel. The prototype aircraft which I flew had a disconcertingly sudden response on initial aileron application, but reworking of aileron shrouds and horn shape will cure this in production aircraft. There was also a noticeable change in lateral trim with speed (right wing down at higher speeds, left wing down at lower speeds) which is a characteristic of the prototype hand-built wings. The aileron trim was low-geared, but effective in cancelling this difference at any speed. I found the rudder control responsive, but heavy despite a sizeable servo tab; and this is exactly as it should be in a jet aircraft, for the rudder is really used only in the circuit.

The air brakes are without doubt the most effective I have ever found in any aircraft. At circuit speeds they produce good deceleration, but at about 220 kt they have an effect like stamping on the brake pedal of a well-equipped car. These brakes consist of a strip of about 5in chord extending under the wing immediately forward of the flaps and over almost the whole flap span. This is balanced by a strip of about 2in chord, but of approximately the same span, which extends above the wing to spoil some lift and provide a compensating trim moment. Actuation is by a sliding switch recessed in the end of the power lever.

In a dive, the Jet Provost gains speed steadily but not so rapidly as to bring a pupil pilot too quickly against the speed limitation (360 kt below 10,000ft, 0.7 Mach above). When the nose is pulled up the speed drops off steadily, but again not with undue rapidity.

Having exercised the basic controls of the aircraft I launched into a series of aerobatics which culminated in a highly unsuccessful stall turn from which we flopped over on to our backs to the accompaniment of muttered apologies and comments from myself and Hunting Percival test pilot S. B. Oliver. I had applied rudder rather too late, at about 120 kt; and when it became clear that I had no more yaw in hand I eased the Jet Provost on to its back with the remaining elevator control in order to avoid a tail-slide. The aircraft took it like a gentleman and showed no tendency to spin. I carried out my aerobatics between 8,000 and 11,000ft, making rolls at 180 kt and loops and rolls-off-the-top starting at 220 kt. Many light aircraft have a strong tendency to drop their noses at the end of a roll, but the Jet Provost could be held well with moderate top rudder. In a loop it did not leave one too long without sight of one horizon or the other. A certain amount of right rudder was required over the top to keep the axis of the loop straight. I found no signs of buffeting and no changes in control characteristics in any manœuvre; neither did I lose much height, though I did not pause between manœuvres.

Before returning to the circuit to try some landings and take-offs I completed a couple of stalls in the fully "dirty" configuration. As the speed fell back, air brakes were exchanged for take-off flap at 135 kt, whereupon a slight trim-change was noticeable. At 125 kt I pressed the undercarriage-lowering button, selected full flap and, throttled back to about 7,000 r.p.m., held height and waited for the stall. The speed fell off without unseemly haste and the nose came steadily up as I maintained height. The speed came past the 70 kt mark, the aircraft buffeted firmly for an instant and then the nose fell cleanly away. There was only a slight tendency to drop a wing, the nose went smartly down a short way below the horizon, and the release of stick pressure was sufficient to initiate recovery. Height-loss was very small. Trying the same again, with the same results, I noticed that a little rudder was needed in order to keep straight in the final few knots above the stall, which came fully at about 65 kt. We had by then used about half our fuel load.

In the circuit I made two landings and an overshoot, and found no difficulty at all. From take-off to the beginning of the final approach there was no need to use the elevator trim; and about one-third aft trim from the neutral point removed all residual forces caused by full flap, undercarriage and reduction in power. The air brakes are not normally used in conjunction with flap, but it is not dangerous to do so and Hunting Percival pilots have often popped the air brakes out immediately before touch-down. Their effect at very low speed is in any case small. There are no pronounced attitudes during the approach, and aileron and elevator control remain precise throughout. The engine is generally left at 8,500 r.p.m. until a safe touch-down is assured, the speed being progressively reduced from 95 to 85 kt the while. Engine response when adjusting the glide-path angle is good. Application of full power for an overshoot a short way from touch-down caused very little trim-change and the climb could be started immediately. The very fast undercarriage retraction was a great asset in this situation.

Touch-down itself is extremely simple. It requires only a very slight check, which can be accurately judged; and as soon as the mainwheels are on the ground the stick can be released to put the nosewheel down as well. The ride after that is directionally stable and comfortable. Having the characteristic lack of drag of a jet

(*Concluded on page 752*)

Comet 4B Postscript

—*and Further Thoughts on Jet v Turboprop Economics*

By J. M. RAMSDEN

"Flight" copyright drawing

Comet 4B: more payload, less drag and lower price add up to a more economical Comet.

THOSE who have tried to make sense of the jet *versus* turboprop cost controversy which has been aired in these pages during recent months may be feeling a little bewildered by it all. But they may at least be clear on one point: the trend of the arguments thus far has been towards establishing not which is the more economic form of transport, but by how wide a margin the turboprop is more economic than the turbojet. It is significant that no convincing academic case has yet been put for the jet.

No doubt keenly aware of all the pro-turboprop arguments, and perhaps because of them, the de Havilland Company last week made this claim for the Comet 4B:—

> "During the period of development of the Comet jet airliner, which included two years of accurately costed operating experience by the British Overseas Airways Corporation and other carriers, it has been generally argued that contemporary propeller-turbine airliners would cost a few per cent less to operate per seat-mile or ton-mile than would the pure jet of comparable function.
>
> "With steady development of the Comet design, including superior engine performance and consumption, the situation has improved in favour of the jet, until we see the Comet 4 intercontinental liner, and the Comet 4A continental (shorter-stage) liner, offering highly competitive figures of operating cost.
>
> "A further advance [the Comet 4B] becomes possible in the field of shorter-stage operations which reduces the seat-mile cost of the Comet by about 15 per cent, a margin great enough to establish without doubt the superiority of the pure jet in regard to operational economy."

This is indeed strong, challenging stuff, and it is certain to make people reach for their slide-rules. It is the first time that the word "superior" has been used to describe the jet's economy relative to the turboprop: always in the past the carefully chosen description has been "highly competitive."

Are de Havilland justified in making this claim? Because if they are—or, rather, if the airlines (who always do their own cost sums) agree that they are—D.H. should have few worries about selling the Comet 4B in quantity. Of all the factors that influence an airline in its choice of equipment, economy is paramount. It has to be, in an industry which is always sailing so near to the wind in its pursuit of profits. Speed, and other factors such as delivery, reputation and trust, are high on the list, and may sometimes override economy—as when Capital chose the 4A. But superior economy is the prerequisite of a transport if it is to sell in quantity, particularly in the U.S. market. If high speed and other advantages can be had for good measure, the airlines should be tumbling over themselves in the rush to buy.

What exactly should one take the phrase "superior economy" to mean when applied to the Comet 4B? It might be taken to imply that the aircraft has a lower operating cost per seat-mile over all the ranges for which it is designed (300 miles to 2,000 miles). Or, to bring in the revenue angle, it could be taken to mean that the 4B has a lower break-even load factor. But both these interpretations would be contested by the protagonists of the short/medium-stage turboprop, except perhaps over 1,000-mile-plus ranges.

The trouble with operating cost as a measure of "economy" is that it may not always tell the whole story. This was the limitation of the many attempts which have been made to establish a comparison between jet and turboprop economics on the basis of operating cost alone.

Lord Douglas (whose Brancker Lecture last February really prompted all the fuss) estimated that, for any given class of operation, the jet would always be 10 to 15 per cent more costly to operate than the turboprop. This estimate was partly based on B.E.A.'s and B.O.A.C.'s measured Viscount 701 and Comet 1 results, from which Lord Douglas assumed that a jet will always prove eight per cent worse in its ratio of *actual* costs to formula costs. *Flight* thought this latter assumption rather Unfair To Jets, and submitted that there should be no discrepancy in formula-to-actual costs between the two types—with the result that, on Lord Douglas's figures, the jet would only be 6 to 9 per cent more costly to operate. But more costly.

And so the discussion went on, with Mr. F. H. Robertson weighing in even more heavily on the side of the turboprop, using his short-cut cost formula to calculate that the margin was as high as 26 per cent. "The public is not going to get a fair deal from the airlines," he wrote. His cost method was not as perfect as it might have been, as correspondence in the R.Ae.S. *Journal* and in these pages suggested: but even with adjustments it still showed the jets to be considerably more costly to operate.

No one from the turbojet camp committed himself to taking exception to these conclusions—perhaps because, as we have said, operating costs may not tell the whole story. Break-even load factor gets closer to the point; but even this may be meaningless if the fares assumed could never achieve the break-even load factor claimed.

After all, a pedal-propelled flying machine for two passengers which requires one drop of oil per year should have a low operating cost per seat-mile. But several million of them might be required to handle a given traffic flow, and an airline might find that a fleet of conventional airliners would require a smaller capital investment. (It might also find that passengers prefer to ride the faster, more comfortable way, especially at the same fare.)

Such a *reductio ad absurdum* may be overstraining the point which jet protagonists have been promoting for years: that the jet offers higher work-capacity because of its higher speed. There is no special magic in this—unless the capacity can be produced cheaply, and unless the speed can be used. The Comet 4B does produce capacity considerably more cheaply than its 4 and 4A predecessors in terms of operating cost per unit-load-mile. It may not produce load-miles more cheaply than a comparable turboprop (though the margin appears from the manufacturer's figures and curves published last week to be small); but fewer may be needed to shift a given amount of traffic at a given frequency, and therefore the airline's total capital investment in a new fleet will be less. Thus operating cost need not always be the deciding factor—though obviously it must be low. But one has to be careful with the "higher work-capacity" argument: the higher block speed to which the jet largely owes its higher work-capacity may well be vitiated on the shorter stages.

The word "economy" when applied to a transport aeroplane looks as though it is taking on a broader meaning, embracing not only low operating cost but also the high unit work capacity which in theory produces a required available-traffic-capacity for a lower capital cost. "Economy" may be said also to embrace in its meaning the intangible earning powers of speed and comfort, commodities which cannot be discounted as mere jet sales-talk.

If all this is accepted, then the phrase "superior economy" applied to the Comet 4B may be justified. It will certainly be disputed in the temples of the turboprop: but perhaps not so vehemently as in the past. Both Bristol and Vickers have their eyes on the jet-transport markets, and as these words are being written the last-named firm has (as recorded elsewhere in this issue) secured a B.O.A.C. order for its VC-10 medium jet project.

It will be enlightening to see what Vickers, a firm steeped in the traditions of the turboprop, have to say about the comparative economics of their new project.

JOHNSTON TROPHY PRESENTED

WHEN the Falkland Islands Dependencies survey ship *Oluf Sven* reached Harwich on May 13 the Johnston Memorial Trophy—awarded to Mr. J. H. Saffery and the pilots and navigators of Hunting Aerosurveys, Ltd., for their work during the 1955-56 season [as announced in *Flight* for March 8, p. 295]—was presented to Mr. Saffery on the quayside by Mr. J. Lankester Parker on behalf of the Guild of Air Pilots and Air Navigators.

Mr. Peter Mott, leader of the expedition, said it had been "a complete success"; 40,000 square miles of the world's most southerly ice-free area had been accurately surveyed by aerial photography and ground survey. Mr. Saffery, the flying manager, had said in an earlier report on the two seasons' work that about 75 per cent of the contract area had been photographed.

CURRENT WORK AT THE N.P.L.

Aerodynamic Developments on Show

Straight-winged half-model used for jet-flap experiments (described in this article) at the National Physical Laboratory

IN the investigation of the problems of missile flight at hypersonic speeds, two interesting and advanced items of equipment are to be used by the National Physical Laboratory at Teddington. One is a new wind tunnel capable of M=10, and the other a large shock-tube in which conditions at M=20 will be studied.

These forthcoming installations are mentioned in the Laboratory's annual report for 1956,* and a pilot-scale shock-tube was on view during the N.P.L. Open Days at Teddington last week. Each year the number of exhibits on this occasion increases: this year the total was 258. Selected activities of the Aerodynamics Division are reported on this page.

The very high temperatures involved in hypersonic flight cause a variety of physical problems new in aeronautics, such as dissociation and ionization, and it is in the experimental study of these high-temperature conditions that the shock-tube is valuable. The new Mach 10 tunnel, a complementary tool, will only reach temperatures up to about 800 deg C—considerably below those of full-scale flight.

The shock-tube in use at N.P.L. at present is 46ft long, and comprises a length of three-inch-diameter piping and an expanded working section. The high-pressure section contains hydrogen and the diaphragm consists of two thicknesses of Mylar plastic sheeting. When the diaphragm bursts (at about 170-200 lb/sq in) the shock-wave travels down the tube (containing low-pressure argon) and is followed by a region in which Mach number, temperature and pressure are uniform. It is in this gas flow, expanded in the nozzle, that realistic measurements can be taken, the uniform-flow conditions lasting for some 100 milliseconds only. Development work is being carried out at present on operating techniques and instrumentation to meet the critical standards demanded by this new method.

Progress in the development of the jet-flap concept was also visible at N.P.L., in the shape of two large half-models in the 13ft × 9ft tunnel building. These had been preceded in the jet-flap programme by exploratory investigations on two small models, which had indicated the magnitude of finite aspect-ratio effects, and had shown the aerodynamic advantages of ejecting the air over a moderate-sized flap rather than from the trailing edge (the "pure" jet flap).

The model illustrated above is the subject of more-comprehensive experiments now in progress. It has a rectangular wing with removable sections permitting an aspect ratio of 3, 6 or 9 to be selected; the air is ejected over a 10 per cent chord, variable-angle trailing-edge flap. The experimental programme is planned as a detailed fundamental investigation of three-dimensional effects, as well as to provide urgently needed data for jet-flap project studies.

The inverted half-model is suspended from an overhead balance and simultaneous measurements are made of the total lift, pitching moment and thrust. The tailplane can be used as a downwash meter. Future work will include the recording of the pressure distribution over the wing surface, and detailed wake explorations.

As a preliminary investigation of the effects of high sweep and low aspect ratio on jet-flap wings, experiments have also been carried out on a half-model of a 60 deg delta wing. Sufficient flap-blowing to prevent flow separation over the trailing-edge flap has been applied, and much larger values of the jet momentum coefficient than before were achieved by employing a low tunnel speed.

Also on show, in the 9in × 3in tunnel, was an aerofoil with distributed suction applied over its whole surface. The effects of suction on shock-induced separation at transonic speeds are being studied, and it is also hoped to use suction to reduce the boundary layer to a negligible thickness and so permit the study of the flow in the absence of boundary-layer effects. The two-dimensional profile has a Perflec porous-metal skin, covering a large number of independently controlled suction chambers.

When suction is applied, low-energy air is removed continuously through the skin surface of the model. The higher-energy air then left to flow along the surface can withstand larger adverse pressure-gradients without separating. The suction also prevents any separation that may still occur under very strong shock-waves from assuming serious proportions.

Control-surface "buzz" at high subsonic and transonic speeds was the subject of an investigation in the 36in × 14in tunnel. Buzz instability is essentially an aerodynamically excited oscillation in a single degree of freedom, the control surface oscillating with an angular motion about its hinge against the stiffness of its control circuit, usually at about 10-40 c.p.s. The N.P.L. experiments are designed to reproduce buzz under controlled conditions and so to obtain information on the flow conditions causing it and on the influence of hinge stiffness. The investigation also provides an insight into the cyclic behaviour of the airflow during the oscillation, and a wider basic knowledge on which preventive measures can be based.

Among the other exhibits in High-speed Laboratory B was an interesting display of recent experimental and theoretical results concerning high-speed flow. These were grouped under the six headings of the onset of separation effects; aerofoil designed to be free from boundary-layer separation at small incidence for all Mach numbers; prediction of pressure distributions when M=1; methods of boundary-layer control; tests on a 6 per cent semi-ellipse; and experimental results illustrating the flow over a swept wing at transonic and supersonic speed.

Included in the last of these items was a curved wing planform designed to overcome the transonic disadvantage (strong shock-wave system and associated high drag) of swept wings of conventional taper; and an illustration of the effect of body shaping on the performance of swept wings at transonic speeds. A form of asymmetric waisting had been devised (involving different amounts of indentation on the upper and lower halves of the body), which gave higher lift/drag ratios at incidence than the transonic area rule—in spite of the fact that the total indentation required was somewhat less.

Other work of the Aerodynamics Department demonstrated during the Open Days included the continued investigation of oscillatory forces on wings with trailing-edge flaps; fabrication of wind-tunnel linings and models from glass-reinforced synthetic resins; flow visualization over swept wings; twin-rotor helicopter model experiments; new developments in supersonic flow investigations; a new 7in × 4½in direct-discharge tunnel (under construction) to operate at Mach numbers up to 4 and stagnation pressures up to 20 atmospheres; and the application of a new micrometer principle to the automatic adjustment of incidence to pre-selected values.

In the studies of oscillatory forces, special apparatus developed by N.P.L. makes possible the direct measurement of all the forces relating to oscillation of the flap about its hinge and to pitching oscillation of the wing about various axes. The Mach number range from 0.4 to 1.8 is being covered.

These were a few of the many ingredients from which visitors to N.P.L. could select their own type of indigestion. Departments other than Aerodynamics were equally active. Control Mechanisms and Electronics had the new ACE, Mathematics had DEUCE, Metrology had the British national copy of the metre. Electricity had an atomic clock, Light showed a screw-cutting lathe working under the control of a diffraction grating, and Ship made force and acoustic measurements on a cavitating hydrofoil. Physics studied the reflection characteristics of absorbent wedges for anechoic rooms, Metallurgy used an improved electron gun for micro-focus X-ray diffraction work. And many other things. When the indoor items failed to attract, one could simply relax on the grass and muse on the gigantic Martian monster which stood in a compound next to the High-voltage Building. Was it *really* only a million-volt testing transformer?

K. T. O.

*"*Report of the National Physical Laboratory for 1956.*" Published by H.M.S.O. for the Department of Scientific and Industrial Research. Price 5s.*

The M.L. Utility Mk 1, with its inflatable wing, "buzzes" cameramen to give them a close-up view. At right, David Masters, the Fairey test pilot who flies the Utility, in the front seat.

AIROPLANE

The Inflatable-wing M.L. Utility Mk 1 Demonstrated

LAST week, at White Waltham, the M.L. Aviation Company, Ltd., gave a remarkable and very convincing demonstration of their Utility Mk 1. In two years of development under M.o.S. contract, the principle of the inflatable wing, originally conceived by the M.o.S. research and development establishment at Cardington, appears to have been well proven.

For the purposes of the demonstration, the wing was blown up in about 15 minutes by a small electrically driven pump, fuel tanks were attached under the wing, the engine was started and the machine took off in a very short space. In bumpy conditions David Masters, the test pilot loaned by Faireys, drove it round very purposefully, clearly displaying its controllability in turns very close to the ground and during several take-offs and landings. After the flight he said that the machine was very light, but remarkably stable directionally and laterally. He doubted whether a Tiger Moth pilot, for example, would find the Utility altogether easy to fly, as it has a delta wing and is controlled by elevons. But there was no great problem in handling and, though a stalling speed of 30 m.p.h. was officially quoted, it was doubtful whether the elevons were in fact powerful enough to achieve the stalling angle of attack. Mr. Masters added that behaviour close to the stall was quite straightforward. About 40 hours' flying have been completed to date.

The Utility Mk 1, registered XK 776 (the second machine built), consists of a two-seat gondola-type open fuselage mounted by faired but unsprung legs on three large-tyred wheels. The nosewheel is directly controlled by pedals for steering on the ground. There is no direct aerodynamic control in the yawing plane and, though the pilot normally uses the rudder bar instinctively, he obtains no directional control in the air from swivelling the nosewheel. On the ground, the nosewheel does give very precise directional control and a very tight turning circle. Cable-operated brakes, controlled from a single lever on the cockpit coaming, are mainly for parking, but they were also effectively used to shorten the landing run.

Mounted on the rear of the gondola, the little inverted four-cylinder Walter Mikron drives a two-bladed wooden propeller. Instrumentation consists of an altimeter with its own static sensing-head attached; a tinplate-and-spring A.S.I. of the Tiger Moth pattern; E.2A magnetic compass; wing-pressure gauge and warning light; and r.p.m. and oil pressure gauges. For test purposes a battery-operated, single-channel V.H.F. set is carried and the pilot wears a parachute. The rear cockpit is decked over and the enclosed space taken up by test instrumentation.

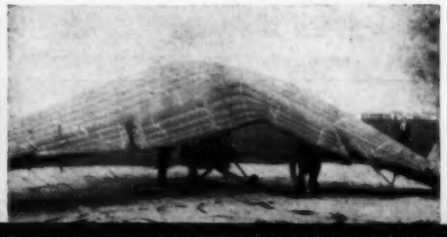
Made up of light wooden spars, with a loose khaki-fabric covering, the gondola carries a longitudinal beam overhead which acts as the locating and support structure for the inflatable wing. A felt gasket prevents scuffing and main wing-to-gondola attachments are in the form of Terylene rope harnesses. This type of rope is also used for the series of lift wires. Four on each side are moored to a fitting on the relevant mainwheel axle and three others are attached at the nosewheel mounting bulkhead. Their length is preset and no rigging adjustments are required during preparation for flight.

The rigidity of the wing is maintained entirely by air pressure at 0.5 lb/sq in, supplied initially by electric or hand-operated pump and, in the air, by an electric pump inside the gondola. This can be left to run continuously or switched on as required. To compensate for increases in pressure caused by continual pumping, or by temperature and altitude changes, a relief valve is built into the underside of each wing, close to the leading edge alongside the gondola. The profile of the symetrical aerofoil (series 0024 modified) is maintained by a number of spanwise porous-cotton diaphragms designed to permit the passage of air during inflation or retard it after damage. A puncture caused by bird strike, rifle fire from the ground, or other incident, would therefore not become catastrophic before the pilot had a chance to make an emergency landing.

The fabric of the wing envelope itself is of rubberized cotton of a drab colour. Elevon hinges are in the form of fabric tubes, which give some stiffness as well as transferring air to these otherwise separate surfaces. A short kingpost and guy ropes maintain the rigidity and required deflection angles of the elevons, the lower end of the post being linked by wooden push-pull rod to the outermost bell-crank of the control run. A length of bungee stretched from elevon trailing-edge to a point on top of the wing provides a form of mass balancing. Another bungee provides a trim force on the stick. The aircraft is generally insensitive to load changes, as both fuel and passenger loads are virtually on the c.g. Larger alterations can be accommodated by shifting the wing on its mounting—on the ground, of course. The very low c.g. materially assists stability.

Fuel load is carried in two cylindrical tanks, each holding six Imperial gallons, slung on tape cradles under the wing and connected to the carburetter by flexible piping. They are filled before being set in place. A fuel-quantity reading is given by a vertical polythene pipe attached to the side of each tank.

Directional stability in the air is assisted by small rectangular



The inflation sequence from the rigged (but collapsed) state to nearly complete erection. The fabric inflation-pipe is attached at one wing-tip. An electrically driven centrifugal air pump does the job in about 15 minutes.
"Flight" photographs

AIROPLANE . . .

fins above the wing opposite the mid-span position of each elevon. The elevons themselves are controlled by bell-crank-and Terylene-rope linkage from a control column consisting of a light metal tube suspended by a universal joint under the wing-supporting keel. A very simple linkage arrangement affords combined and differential movement of the control surfaces.

When the Utility is stationary on the ground all control and bracing ropes hang disconcertingly loose; but they become taut as soon as the machine is airborne, and the makers report that no aeroelastic problems have been encountered during the 40 or so hours flown to date. The highest speeds so far reached have been in the region of the quoted maximum speed of 58 m.p.h. The greatest height so far reached is 700ft.

In the air the Utility does indeed appear to have surprising directional stability, though it occasionally tends to yaw a little. The rate of roll seems quite slow, but otherwise the response to control movement appears remarkably good; and Mr. Masters certainly handled the machine with great confidence and dash.

Though the Walter Mikron is nominally rated at about 60 h.p., special fuels have had to be used to keep it cool in its sheltered pusher installation. Large cooling-air scoops have been attached as well. The special fuels have decreased take-off power to only 38.5 h.p., but the Utility nevertheless displays a creditable amount of surplus urge. The wing loading is a mere 2.5 lb/sq ft.

On the ground, the craft is surprisingly stable in a fresh wind. It stands squarely on its 7ft 5in track undercarriage and sways only very slightly. It can, in fact, be comfortably inflated and prepared for flight by two men in calm weather and certainly did not demand the attentions of more than three in the fresh breeze at White Waltham last week. The present limiting wind speed for erection and operation is 20 kt, but landings and take-offs must not be made more than 10 deg out of wind—mainly because the upwind wing would otherwise tend to lift.

No production order has so far been placed for the Utility. It was originally envisaged as a reconnaissance and communications aircraft for use by army officers of about company commander status. In this rôle, it would be towed to operational areas behind a car, with the wing deflated, rolled up and stowed inside the cockpit. The tow-bar would be attached to the swivelling nose-wheel mounting. Though there are also obvious civil applications in areas with poor road communications, or purely for pleasure flying, the manufacturers are not prepared to make any firm statement about the availability of the machine until various details of the project have been more fully explored. This would take about a year to do. As yet the Utility has no Certificate of Airworthiness. The price would be approximately the same as that of a family car—anything between £400 and £900.

M.L. Utility Mk 1 (Walter Mikron III, derated).—Maximum speed at 38.5 h.p., 58 m.p.h.; cruising speed at 35 h.p., 50 m.p.h.; stalling speed, 30 m.p.h.; sea level climb, 690 ft/min; take-off run, 90 yd; distance to clear 50ft, 165 yd; endurance, at cruising speed, 2½ hr; ceiling, 5,000ft. Weight (empty) 515 lb, fuel (12 Imp. gal.) 85 lb; pilot 180 lb, passenger 180 lb, baggage 40 lb total weight, 1,000 lb. Span, 35ft; root chord, 17ft 6in; tip chord, 5ft 9in; overall length, 23ft 3in; wing area, 400 sq ft; overall height, 10ft 6in; wheel base, 7ft 1in; track, 5ft 4in.

Burtonwood Entertains

"ONE of the largest U.S.A.F. bases in the world," said the programme, "Burtonwood supplies everything from the smallest piece of electronics equipment to trucks and aircraft engines."

None of the 20,000 who on May 18 flocked to the big American establishment in Lancashire for U.S. Armed Forces Day doubted the statement after a full day there. Their weary feet [writes a North Country correspondent] proved the first part of the statement and the evidence for the second was laid out for them to see.

The crowded sky above South Lancashire, say the Americans, does not permit a flying display, so a static show of aircraft was arranged. Star of the line-up was undoubtedly the Douglas RB-66B (54-506A) from Sculthorpe, and this had its crowd of admirers all day. British participation this year was greater, and two aircraft in the R.A.F. ranks ran the RB-66B a close second. These were a Valiant (WZ405) of No. 207 Sqn., and a Comet 2 (XK695) of No. 216 Sqn. The Valiant, flown by S/L. H. A. Smith, D.F.C., had, in fact, taken part in the B.B.C. television feature on the R.A.F. three nights before. A Convair T-29A (49-1941A) and a Javelin (XA731) also attracted a great deal of interest for these, too, are rare sights to Northern enthusiasts in the ordinary course of events.

Although there was no flying display as such, most of the R.A.F. aircraft and an F-84F (52-6534) took off for home before the crowds had left. A Beverley (XB285), indeed, seemed to surprise the Americans by its short take-off and rapid climb-away. They were already greatly impressed by the Comet and the Valiant and more than one observer was heard to express his pride at seeing the former—the only jet transport in service with an air force of the free world—attracting the interest and admiration of U.S.A.F. members.

Other aircraft on show were: C-123B Provider (54-630), T-33A Silver Star (53-5150), C-47D Dakota (50-348809), F-86D Sabre (52-10028), WB-50D Superfortress (49-302A), R6D-1 (131620), C-124C Globemaster (53-0010), C-119C Packet (51-2630A), Venom (WR783), Canberra B.6 (WH727), Vampire T.11 (XD458) and Hunter 6 (XG185).

JET PROVOST in the Air (continued from page 748)

aircraft, the Jet Provost rolls happily on for some way after touch-down. Luton's sharply undulating grass surface and downhill landing run threw the aircraft about considerably and made it virtually impossible to use any strong braking until the final part of the run. Rudder remained effective above about 40 kt and then gave adequate steering control.

The toe-pedal brakes make application of right rudder and left wheel brake possible for strong cross-wind conditions. With the foot normally placed on the rudder pedals the ball of the foot rests continuously against the brake pedal, but there is sufficient resistance to movement to make this quite comfortable and to avoid any risk of applying brake inadvertently before or during touch-down. The brake installation, now hydraulic, is by Palmer.

A good deal of power is required to initiate a turn while taxying slowly on grass, but about 8,000 r.p.m. will keep the aircraft rolling comfortably and gentle turns can be very easily made. It is pleasant to taxi along with the controls locked, controlling the aircraft entirely with brake pedals and an occasional touch of power.

I was at first delighted to see that there were no sharp edges in the cockpit to damage the knuckles, even close to the hood-winding handle, but I was later a little disillusioned when I left a fragment of my little finger on the parking-brake catch. In general, the cockpit is very comfortable and a congenial atmosphere can be obtained from the combination of ventilator, heater and good draught exclusion. Windscreen wipers, alcohol de-icer pump and hot-air demisting should avoid unpleasant blind landings. Electric blind-flying instruments to the latest standard should ensure that a pupil never has "nothing on the clock." The Jet Provost is not short of normal decent comforts and certainly offers outstanding qualities as a trainer.

Jet Provost T. Mk 3* (Armstrong Siddeley Viper ASV. 8).—Basic weight, 4,469 lb; disposable load, including two pilots and 165 Imp gal AVTAG (wide-cut gasoline fuel), 1,646 lb; maximum weight, with tip tanks, 7,050 lb.

Performance (latest figures).—Take-off distance to 50ft, 2,010ft; landing distance from 50ft to stop, 1,963ft; max speed at sea level, 266 kt; max speed at 30,000ft, 286 kt; ceiling, 1,000 ft/min, 21,700ft; ceiling, 400 ft/min, 33,500ft; times to height, 10,000ft, 4.7 min; 20,000ft, 11.4 min; 30,000ft, 24.7 min; endurance at 20,000ft, 1.6 hr; range at 20,000ft, 270 n.m.

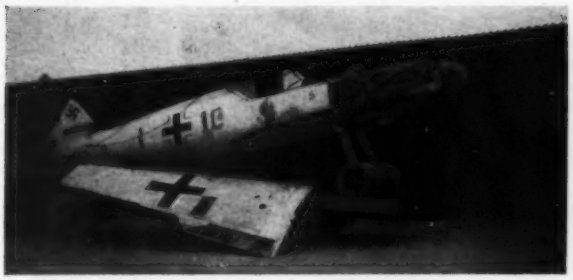
*Production version with ejector seats and other modifications.

AGRICOLA DESIGNER'S N.Z. VISIT

DURING his recent visit to New Zealand to see how the Agricola is faring, Mr. R. E. Bird, chief designer of Auster Aircraft, Ltd., watched it operating under workaday agricultural conditions for the first time on May 9 in the Ohariu Valley.

Mr. Bird stated in Wellington that the Agricola's design had been decided on after a visit to New Zealand four years ago. It had been well tested in Britain but it was not possible to simulate actual New Zealand conditions, so for that reason he was pleased to see it operating there and was delighted with its performance.

Another purpose of Mr. Bird's visit was to canvas the opinions of flying clubs and other operators of light aircraft. He said that in satisfying the requirements of flying clubs, British firms had been handicapped by the lack of suitable engines. Auster were now able to import American engines and had produced the prototype of an aircraft which should enable Britain to improve its position in this field. The company also had an alternative design and would seek advice as to which was preferable.



(Above and right): Typical wartime loads, enemy and friendly, that came the way of Dallas (Kingston), Ltd.: Me 109, Ju 88 and Oxford.

Highway to the Air

Moving Aircraft by Road: Specialized Haulage Work

STOPPING for petrol in a small Hampshire town not so very long ago, we became aware of turned heads, of something interrupting the workaday flow of vehicles through the High Street. A police motor cyclist, looking purposeful and waving oncoming traffic to its own side, accelerated past.

"Royal car," we thought. We were wrong. In a moment the cause of the stir became apparent—a lorry with a long, low trailer carrying a load that seemed to fill the narrow street. "It's a submarine," said a woman with a perambulator. "No it ain't, Mum," said a small boy with her. "It's an aeroplane."

And like most small boys in such situations he was right, though Mum's misinterpretation was pardonable, for the long cylindrical form, swathed in adhesive-paper protective wrapping, looked heavy and ungraceful, and very much out of its element. Though recognizable chiefly by its window-shape as the fuselage of a Viscount, it presented the oddest contrast to the sleek, glinting turboprop airliners so familiar at any major European airport.

Lettered on the lorry was the name "Dallas (Kingston), Ltd.," and on the trailer, "Dallas for all aircraft and boat transport."

Later we were to find out more about the haulage firm concerned, for—as the words on the trailer suggested—this was no exceptional operation, but a routine job for an organization which has been specializing in awkward loads of this kind for many years past.

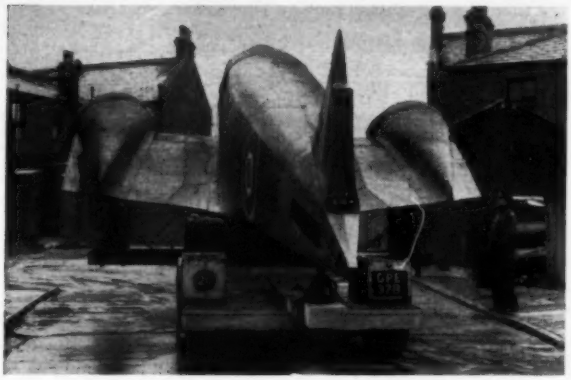
It is not surprising that, with headquarters in New Malden, Surrey, only a mile or two from Kingston-on-Thames, the company should have received its first aircraft-transport contracts from Hawker Aircraft; this was in the early 1930s, when such comparatively small and easy loads as Hawker Harts were taken from the Canbury Park Road works to Brooklands for flight testing and subsequent delivery flights. Even in these days there was an occasional order from Vickers, though for the most part the products of the Weybridge firm were flown straight out from Brooklands.

Mr. W. T. Dallas, who directs the company, treasures a considerable collection of photographs of aircraft and boats which they have moved. (A big cabin cruiser on the road, incidentally, looks even more out of its element than does an aeroplane.) Among the pictures is one—not quite clear enough for satisfactory reproduction here—showing the Bellanca monoplane *Dorothy* (former *Irish Swoop*) which Jim Mollison flew from Harbour Grace, Newfoundland, to Croydon in 13 hr 17 min, making a coast-to-coast record of 9 hr 20 min; this was in October 1936.

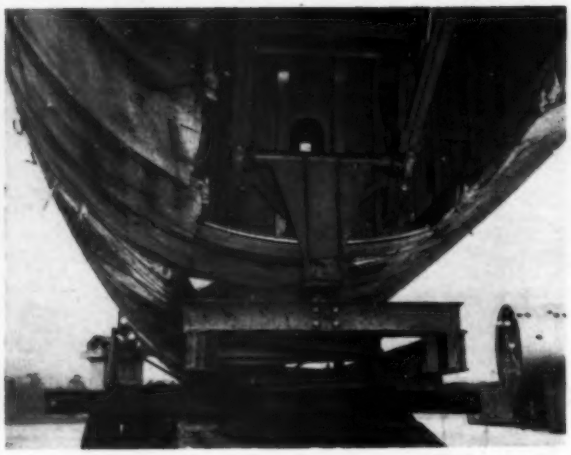
During the succeeding months the tempo of the work began to quicken, with the emphasis on military aircraft; such famous types as the Fairey Battle and Gloster Gladiator were moved in large numbers. By the time war was declared in 1939, orders for the road transport of aircraft were flowing in. One of Dallas's biggest contracts was for moving Airspeed Oxfords, which were carried on six-wheel Leyland articulated semi-low-loaders, the fuselage (complete with centre-section and engines) being accommodated with its own undercarriage resting on a transverse 20ft girder, and a rearwardly extending girder supporting the tailwheel. The first order was for moving 100 Oxfords from Eastleigh to various parts of the country. Another regular job was the bringing of Westland Lysanders from Yeovil to London, where they were packed for sea transport to the Middle East and other destinations.

Not all the loads at this time were factory-fresh English aeroplanes. A good many were German ones, very much the worse for wear. At any time of the day or night Dallas were liable to be asked to collect crashed enemy aircraft from fields up and down the country, and to transport them to such establishments as Farnborough for detailed post mortems. But the R.A.F. were meanwhile developing their own M.T. fleets and techniques, and during the Battle of Britain, when the countryside was more or less littered with fallen enemies, they took over the job entirely.

Some five years ago, after a fallow post-war period, the firm re-entered the aircraft-transport field on a considerable scale, fulfilling contracts for a number of well-known constructors. Chief among these has been Vickers-Armstrongs, with movements of Viscount 700 fuselages in both directions between their Weybridge



Big stuff: a Comet 1A fuselage and (bottom picture, typical of the loads being moved today) a production Viscount.



How Viscount fuselages are secured firmly on the trailers, by the spar attachments aft (left-hand picture) and nose-wheel attachment forward. Secure fixing of this kind is essential, both to preserve the load from damage and as a safeguard against the effects of road vibration and wind-gusts.

HIGHWAY TO THE AIR . . .

works and that at Hurn, near Bournemouth—a road journey of about 80 miles. Currently, some of the V.800 fuselages built at Hurn are being brought up to Weybridge for final assembly.

The vehicles used by Dallas for this work are mainly powerful and compact A.E.C. Mercury four-wheelers towing a 33ft 6in trailer by means of an extended drawbar to give the necessary clearance between the vehicle and the aircraft nose. The fuselage is firmly secured at three points—at the nosewheel attachment and at each of the main-spar attachments, slave fittings being provided to carry the load to the trailer members.

Transport operations of this kind call for thorough planning, involving close co-operation with the police, motoring organizations and local authorities—and, of course, highly experienced drivers are essential. Two police outriders warn oncoming traffic and deal with unexpected obstructions or other difficulties. Sometimes, particularly at acute corners, it is necessary temporarily to remove "keep left" signs. Routes must be carefully worked out, especially in the matter of bridge-heights; and here there may be pitfalls—or, more accurately, just the reverse, for the clearances indicated by the notices on bridges are sometimes unexpectedly reduced by road repairs that raise the surface-level.

But skill, experience and forethought by all concerned combine to achieve a successful operation. "I can't recall that we've had a single instance of even slight damage," Mr. Dallas told us; and his company's methods suggest that this record has a very good chance of being maintained.

On another aspect of the company's work—the transport of civil and military aircraft simulators, a single one of which may require a fleet of eight or more vehicles—we hope to publish a note in the near future.

BALL IN TOUCH

A DEVICE with possible applications in test and development flying was demonstrated recently in Melbourne to representatives of Australian, British and American aircraft and instrument firms, and failures were simulated in an aircraft of the Australian Civil Aviation Department in order to show the method of operation.

The inventor, Mr. R. H. Orgill, displays the detector strips in one half of the sphere.

The apparatus has as its main purpose the identification and recording of failure in any one of a number of parts of the structure of an aircraft in flight. In brief, it consists of 24 detector strips, individually wired to what a news-story from Australia describes as "pressure-switch and insulator plates in vulnerable parts of the aircraft." On a signal being received from one or more of these parts the appropriate strip (or strips) is heated electrically and becomes discoloured.

The strips are fitted in a spherical container about the size of a football, which also houses a battery that makes operation independent of the aircraft electrical supplies. The container—which weighs about 10 lb, is shockproof, and will float in water—is housed in the tail of the aircraft "and automatically ejects itself when a crash occurs."

Interesting possibilities—especially for the aircraft designer—are implied in another passage from the Australian report: "In the second half of the ball, a miniature tape recorder captures the sounds of the breakages, and also any statements which the pilot may make."

It is apparently the hope of the inventor—Mr. R. H. Orgill, an electrician—that the device might be installed as standard equipment in airliners. Its suitability for such a purpose was discounted by one of the aircraft company representatives, who remarked upon the complexity of warning devices already installed in such aircraft. But—to quote the story again—"For other planes, however, this expert felt there was undoubtedly scope for the invention, which could be developed profitably for the welfare of the industry."

REWARDS FROM ABROAD

DURING the past five years British aircraft and aero engines manufactured abroad under licence have earned almost £25m. In the House of Lords recently Lord Mancroft, Parliamentary Secretary to the Ministry of Defence, gave figures of "royalty payments for the manufacture of aircraft and aero engines abroad (including lump-sum fees for the granting of licences)." These figures, which include the value of some of the material and parts supplied to the licensees, were as follows: £2,562,000 (1952); £4,240,000 (1953); £4,264,000 (1954); £6,736,000 (1955); and £7,007,000 (1956).

Of the 14 types of British aero engines for which manufacturing licences have been granted in nine countries, the Armstrong Siddeley Sapphire has been built in the greatest quantity, over 8,000 having been made so far in the United States. More than 4,000 Rolls-Royce Nenes and Tays have also been manufactured there.

The English Electric Canberra has figured prominently among the eight types of aircraft made in eight overseas countries, over 350 having been built in the U.S.A. (as the B-57) and a further number in Australia. In recent months licence agreements have been signed for the manufacture of Folland Gnats in Finland and India and for Bristol engines in the U.S.A.

The figures quoted by Lord Mancroft do not include royalty payments—which amount to a substantial total—for equipment and components manufactured abroad.

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns; the names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

That Vertical Airship

IN your issue of March 15, 1957, you reprinted a picture of the dirigible *Los Angeles* standing on its nose on top of the mast. This elicited considerable scepticism and controversy aired in the subsequent issues of March 29 and April 19. In the former, on page 420, you requested American readers to confirm.

The incident as depicted actually happened at Lakehurst Naval Air Station. I was right there, at the foot of the mast. The dirigible, while riding in normal attitude moored to the mast, with a slight amount of up-elevator held, was suddenly caught in a change of wind; the prevailing wind speed died down and a new wind sprang up in the opposite direction. This lifted the tail up and swung the dirigible over the top within approximately ten degrees of the vertical. There she rolled over and came to rest in horizontal attitude on the opposite side.

The reproduced picture was taken by a Navy photographer stationed several thousand feet away. The building at the foot of the mast was a relatively small shack less than 20ft high.

Santa Monica, Calif. W. B. KLEMPERER.

[This letter will, we hope, convince those correspondents who sought to cast doubt upon the genuineness of the picture. Dr. Klemperer, now chief of the missiles research section of Douglas Aircraft, was at one time research engineer to the Zeppelin company and later to the Goodyear-Zeppelin Corporation; he also had a distinguished record as a glider pilot in the 1920s—Ed.]

OY-DEM: Its Pilot's Recollections

WITH reference to Mr. Peter W. Moss' letter in *Flight* of May 10, 1957, page 642, I think I can tell him a little about the Focke-Wulf Condor OY-DEM, because I was the pilot who "parked" this aircraft on Northolt on September 4, 1946, after a scheduled flight from Copenhagen. I landed in a strong crosswind and the aircraft ran off the runway and hit a small obstruction, so I did not dare to pull up again. I could not brake on the slippery ground and had to make half a ground loop to stop before the boundary. That's all! As the aircraft was somewhat damaged and it was impossible to get spare parts, OY-DEM was finally dismantled on Northolt.

The story of OY-DEM is rather dramatic; here are some points: used on the Copenhagen - Berlin - Vienna route during the war (in secret understanding with the Allies); on many occasions grounded on airfields in Germany during Allied bombing raids, while the crew and passengers were hiding in the nearest shelter; a belly landing in Vienna due to undercarriage trouble; forced landing in Copenhagen after being hit by German flak; fire in mid-air due to failure of cabin heater system; failure of the course steering mechanism, which nearly shook the aircraft apart in mid-air; and an "accident" arranged in neutral Sweden to keep the aircraft out of Denmark in the last hectic days of the war.

After the war OY-DEM was used mostly on Scandinavian routes, but the Condor was u/s for long periods due to shortage of spare parts. At the day of the accident on Northolt, the aircraft had not been airborne for about five months.

D.D.L. had only two Condors, but spare parts were "organized" from one or two Luftwaffe-Condors left around in Denmark after the war.

Kastrup, Copenhagen. H. KIERKEGAARD.

Up-to-date G.C.A.

I RECENTLY had the opportunity of inspecting the G.C.A. equipment being used by the United States Air Force at Bovingdon and was greatly impressed by what I saw.

There are but two positions in the truck occupied by operational personnel. Each of these positions has search and precision displays, so presumably aircraft are handled at each position in turn, one operator controlling the entire operation from identification to touch down. The twelve-inch search 'scope is at (sitting) eye level, with the elevation and azimuth precision displays immediately below one above the other and angled.

Search radar has a maximum range of 30 miles at 4,000ft, but height coverage can be increased by tilting the aerial and range increased by offsetting the trace so that any desired quadrant can be "blown up." M.T.I. is fitted for the elimination of unwanted static echoes, plus facilities for cutting down returns from precipitation.

Precision displays are larger than on the old wartime G.C.A., and only two tubes are used, one for elevation and one for azimuth, thus doing away with the need for elevation trackers. Glide-slope and centre line are superimposed electronically on each display, and "servo-ing" would seem to be either automatic or unnecessary. On the azimuth (lower) display the echo moves from right to left rather than from bottom to top as was the case with the earlier G.C.A. The Bovingdon equipment was made by Gilfillan.

My description is unfortunately rather sketchy, but as I was in the truck as a member of the public, and many other members of the public were clamouring for admittance, I had only about five minutes to look round.

It would seem, however, that this equipment is way ahead of any other G.C.A. in operational use at the moment, the only possible disadvantage being that the integration of the search and precision elements might have the effect of slowing down the landing rate.

New Barnet, Herts. J. M. WILDE.

"Tripehound" Memories

THE series of excellent articles by Mr. J. M. Bruce must continue to give great pleasure to a very large number of your older readers. They certainly have to me, and I look forward keenly to each new report—long may they continue.

Article No. 16 in the series in *Flight* of April 19, on the Sopwith Triplane, brings back most vivid memories.

In 1916 I was a cadet at the R.N. College Osborne, and was passionately interested in the R.N.A.S., to which service I had hoped to transfer at the earliest opportunity, and in connection with my interest I had had the good fortune to make friends with Sqn. Cdr. Theodore D. Hallam, D.S.C. and two Bars, a Canadian who was then commanding Royal Naval Air Station Hendon, where I spent much of my time when on leave from Osborne.

One afternoon in 1916 I had just arrived at Hendon to pay a visit to the C.O. when overhead I heard the familiar *blip blip* of a rotary engine; looking up, I was astonished to see a triplane, the first I had ever seen, coming in to land.

This aircraft was, I think, probably the prototype triplane N.500 and was being tested by Hardcastle, the Sopwith test pilot.

I had been accustomed to see D.H.2s, D.H.5s, Pups and Curtiss J.N.4s flying. In one of the last-named, piloted by Sqn. Cdr. Hallam, I had had my first flight in January 1916, and the performance and manœuvrability of the Sopwith triplane in the hands of the Sopwith Company's test pilot seemed miraculous in comparison.

When Hardcastle landed, many R.F.C. officers came running over from the other side of the aerodrome where the R.F.C. contingent was stationed; the Navy promptly stationed sentries round the triplane and kept the unfortunate R.F.C. types at a distance; not a very friendly gesture, but as a young Naval cadet I was suitably impressed by the superior attitude adopted by my Service.

Brighton, Sussex. J. A. LESLIE MOORE.

FORTHCOMING EVENTS

May 24-June 2. Paris Aero Show, Le Bourget.
May. 31-June 1. Aero Club of South Africa: Governor-General's Air Race.
May 31. Royal Institution: "How Glue Sticks," by N. A. de Bruyne, M.A., Ph.D., F.Inst.P.
June 1-2. Aero Club of Western France: International Rally, Anjou.
June 5. Kronfeld Club: "Gliding in Australia," by Cdr. G. A. J. Goodhart, D.S.C., R.N.
June 5-7. Institute of Navigation: "Avoidance of Collision by Shipborne and Airborne Means," a Three-day Conference in conjunction with the French and German Institutes.
June 8-10. Fréjus-St. Raphael Aero Club: 4th International Rally, Fréjus.
June 9-10. Austrian Aero Club: International Rally, Vienna/Aspern.
June 9-10. British National Model Aircraft Championships, R.A.F. Waterbeach.
June 9-10. Leinster Aero Club: Annual Display, Weston Airfield, Dublin.
June 9-16. Western France Aero Club: Angers Gliding Week, Angers.
June 10. Royal Aero Club: Aerobatic Competition, White Waltham.
June 10. Royal Dutch Aero Club: 6th International Air Display, Ypenburg.
June 13. Aerodrome Owners Association: Forum on Helicopter Landing Sites.
June 15. Northampton Gliding Club: Open Day, Sywell.
June 15-16. Lower Normandy Aero Club: 10th International Rally, Flers.
June 15-17. Le Zoute Aviation Club: Invitation Rally.
June 17-20. I.A.S.: National Summer Meeting, Los Angeles.
June 17-29. Institute of Welding: British Commonwealth Welding Conference, London and Saltburn-by-the-Sea.
June 19. Kronfeld Club: Film Show.
June 21-24. Palermo Aero Club: 9th International Aerial Tour of Sicily, Palermo.
June 24. F.A.I. Annual Conference, Palermo.
June 29-30. Invitation Rally, La Baule.
Sept. 2-8. S.B.A.C. Show, Farnborough.

THE INDUSTRY

The Airscrew Company's Agreement

FURTHER details are now available of the financial arrangement recently agreed between the Airscrew Co. and Jicwood, Ltd., on the one hand and Bryant and May, Ltd., on the other.

The Airscrew Co. and Jicwood, Ltd., of Weybridge, Surrey, have been well known in the aircraft industry for many years, originally as propeller manufacturers and latterly for a wider field of products, notably aircraft panelling, bulkheads, transit containers, ventilating equipment and wind tunnels. A large proportion of their output is for industry generally. Bryant and May, Ltd., are, of course, internationally famous as match manufacturers.

In a circular to stockholders, the Weybridge firm's new chairman, Mr. Eoin C. Mekie, C.B.E., explains the need for additional working capital in order that full advantage may be taken of a steadily growing demand for the company's products. He goes on to say that under the terms of the agreement Bryant and May are to invest £500,000 in the company, and that two of their representatives will join the Board.

Mr. Mekie succeeds to the chairmanship of the Airscrew Co. following the death last month of its founder, Mr. J. D. Titler. The latter was also managing director, and that post now goes to Mr. F. C. Lynam, F.R.Ae.S., A.F.I.Ae.S.

A man of business interests ranging from the manufacture of man-made timber to publishing, Mr. Mekie is well known in aviation as chairman of British Aviation Services, Ltd., whose subsidiaries include Aquila Airways, Britavia, Ltd., and Silver City Airways. Mr. Lynam entered the aircraft industry in the early 1930s. For four years before joining the Airscrew Co., he was with the Croydon firm of Metal Propellers, where he was engaged principally in the design of hollow-steel propellers.

Hordern-Richmond Rotor Blades Approved

AT a luncheon in London on May 22, Mr. R. E. Hardingham, the secretary and chief executive of the A.R.B., presented to Hordern-Richmond, Ltd., approval documents for the rotor blades which they are now manufacturing for Bell and Hiller helicopters. Although the tests of these blades were concluded successfully in November last year, the celebration marked the completion of the development and approval stage and cleared the way for limited production—Hordern-Richmond estimate an initial four or five sets a month.

The approval of these British-manufactured blades (they closely follow Bell and Hiller practice) required an extended period of ground and flight testing. The firm found it necessary to purchase a Bell 47G helicopter for this work, which was done at Derby (for the Bell) and in conjunction with Fison-Airwork at Bourn for the Hiller. After calibration of the engine and stripping of the complete transmission line of the 47G for a dimensional check, a 50-hr strain-gauge ground test was performed at Derby, followed by 55 hours of flight testing, with interim re-calibrations and transmission checks at each stage.

The rotor blades consist of metal reinforced laminated Hy-du-Lignum leading edges with balsa fillets, the whole being glass-fibre covered—a process with which this firm has considerable practical experience. The result is a blade that has excellent elasticity and recovery properties, can be repaired, and is relatively cheap: a set of Hordern-Richmond Bell main-rotor blades sells for less than £1,000. For Continental operators this should be an attractive alternative to purchasing additional blades from across the Atlantic with dollars.

It is stated that fatigue is unknown in this type of construction and that similar Bell-manufactured blades have logged flying times of up to 10,000 hours; there seems little reason why Hordern-Richmond should not similarly extend to a substantial number the hours for which their blades are approved.

A New Crash Tender

AN airfield crash tender made by the old-established fire-appliance firm of Merryweather and Sons, Ltd., Greenwich High Road, London, S.E.10, has recently been exported to the British West Indies for use at Piarco Airport by the Trinidad and Tobago Fire Services. It has a four-wheel-drive chassis to assist operations over soft ground and carries—in the words of its manufacturers—a "formidable battery" of fire-fighting equipment.

The main pump, rear-mounted, is driven by a single-stage Merryweather turbine handling 450 gal/min at 160 lb/sq in or 550 gal/min at 120 lb/sq in. When approaching a burning aircraft the tender can bring to bear its full armament of foam, carbon dioxide, water and high-pressure water-fog—using all or any of these as required.

So as to get as close as possible to a fire, the tender can project forward a heavy screen of fog and/or CO_2 through nozzles and projectors housed under the front crash-bar and controlled from the cab. This screen protects the tender and its occupants while the main weapon—a roof-mounted foam monitor operated by a member of the crew standing inside the cab with head and shoulders through the roof—is brought into action. There are also two roof-mounted fog nozzles for operation by hand. The tender's CO_2 equipment includes four 40-lb gas cylinders.

Foam, CO_2 and "fog" form the fire-fighting armament of the Merryweather crash-fire tender described in a news-item on this page.

Canadair Re-organization

EXTENSIVE changes of appointments in the manufacturing division of Canadair, Ltd., Montreal, have been announced. Mr. Robert A. Neale, vice-president manufacturing, explains that "the new divisional organization by product lines establishes aircraft manufacturing and special weapons manufacturing as natural sub-divisions, although other sub-divisions may follow as development of company products warrant. Each product-line organization must, to the greatest degree possible, be self-sufficient . . . in order to ensure accomplishment of quality, cost and schedule objectives."

Among re-appointments of senior executives are the following:—

T. V. Chandler (formerly director of manufacturing administration) is appointed manufacturing administration director, responsible for the direction of procurement, industrial engineering, and for the establishment of master scheduling, long-range planning and operations research functions.

Robert J. Higman becomes special weapons manufacturing director, "responsible for the establishment and direction of an appropriate organization to accomplish the task of weapons manufacture." He was formerly manager of manufacturing engineering.

H. L. McKeown, formerly director of manufacturing operations, is appointed quality control director on a company-wide basis with control over all production programmes involving aircraft, missile and associated projects. Robert B. Cockrill remains as quality control manager, aircraft, while G. N. Arnison is appointed quality control superintendent, missiles.

Walter H. Meacher becomes industrial relations director (a change in title from that of manager) and continues to be responsible for all industrial relations activities. Charles A. Ulsh is appointed aircraft manufacturing director, responsible for all factory, manufacturing engineering and plant engineering activities as now constituted. Formerly factory manager, Mr. Ulsh is succeeded by R. S. Campbell as aircraft factory manager.

A number of appointments in the sales division were announced on page 720 of *Flight* last week.

IN BRIEF

The T.L. Process for soft-soldering aluminium—devised by Tiltman Langley, Ltd., Redhill [and described in *Flight* for January 27, 1956, p. 121]—is to be introduced into the United States and Canada following an agreement between Tiltman Langley and the Reynolds Metal Co. of the U.S.A.

* * *

Referring to a news-item from Holland quoted in the article "Thoughts on British Missiles" (*Flight*, May 10), Mullard, Ltd., state that there has been no collaboration in guided-missile projects between their company and the Dutch N. V. Philips organization.

* * *

Proceedings of the recent *Rubber in Engineering* conference (held in London last September) have now been published in book form. The 160 pages, together with more than 100 illustrations, cover the five papers given and the discussions they inspired. Copies may be obtained free of charge from the Natural Rubber Development Board, Market Buildings, Mark Lane, London, E.C.3.

* * *

What is believed to be the first specialist plant in the rubber industry to be air-conditioned and provided with humidity control has been erected by Precision Rubbers, Ltd., Bagworth, Leics. Due to go into operation at the end of May, the factory has been designed exclusively for the production of silicone rubbers to meet the demands of the aircraft, engineering and nuclear-energy industries.